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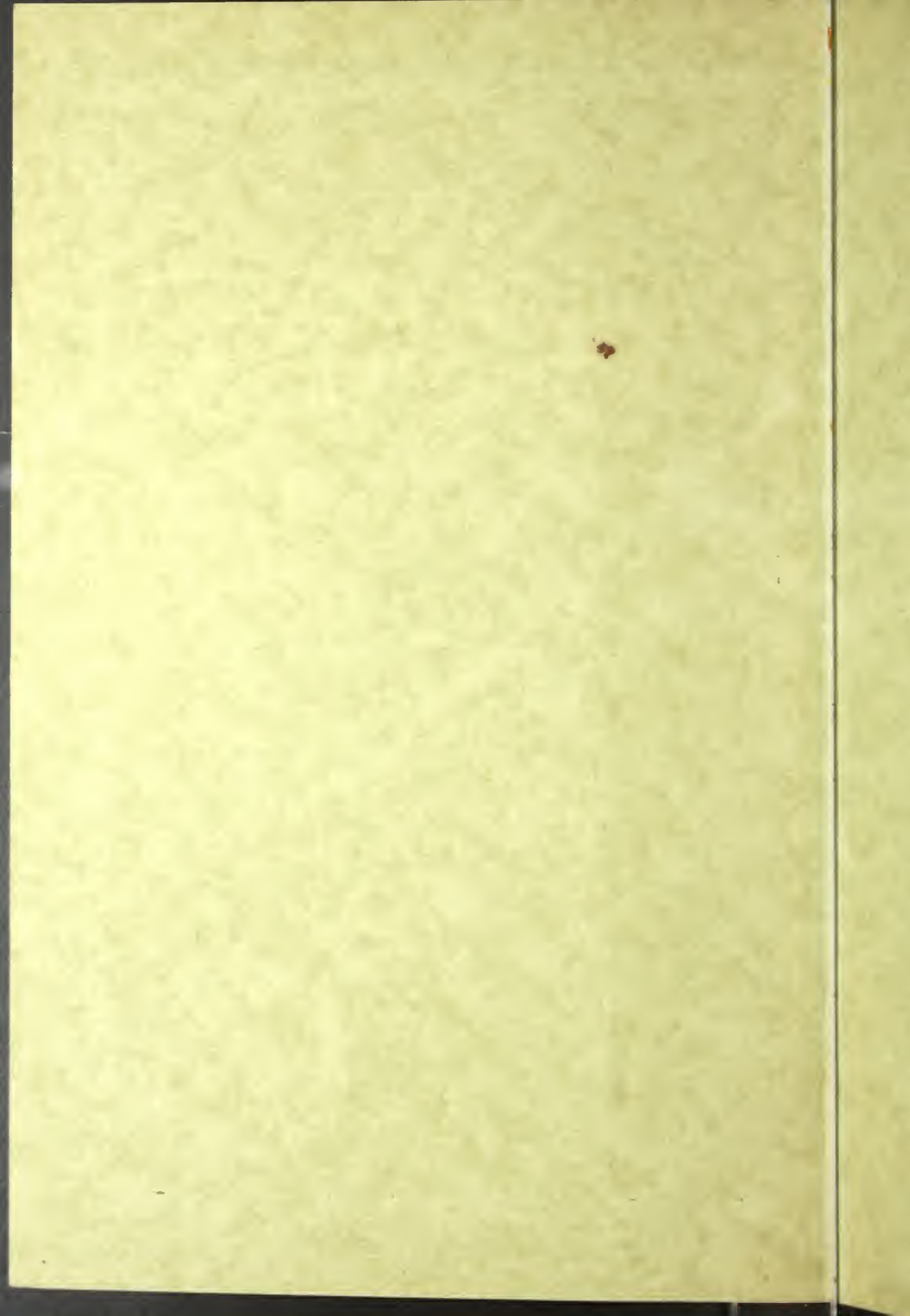
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THE WATERPROOFING HANDBOOK

691.1

Waterproofing







The Waterproofing Hand-Book



Trade Mark

*Describing and illustrating economical and effective methods of
Waterproofing Concrete and all forms of Masonry—of
preserving decorative effects, exterior and inte-
rior—of protecting finished surfaces against
water, wear and stains—by the use of*

GF Waterproofing Products and Technical Paints

Copyright 1914 by
The General Fireproofing Company

The General Fireproofing Co.
YOUNGSTOWN, OHIO

CHICAGO OFFICE	-	-	-	-	325 W. Madison Street
ATLANTA OFFICE	-	-	-	-	Third National Bank Bldg.
EXPORT OFFICE	-	-	-	-	395 Broadway, New York
LONDON OFFICE	-	-	-	-	34-36 Gresham St., E. C.



What Means in Waterproofing Products

IN the compilation of this book, an effort has been made to confine it to the solving of problems in waterproofing met in everyday construction—to realize that there is more than one way to solve such problems and to show the best method in each case, and alternate suggestions where it seems advisable.

The merits of the materials themselves have been subordinated to the more vital information as to results obtained by their use, with the hope that the book will be of such real assistance to Architect, Contractor and Builder that the use of GF Waterproofings will follow as a matter of course.

As to the reliability of the materials, it need only be stated that after a two years' investigation of all the best known waterproofing materials on the market, The General Fireproofing Company has acquired an interest in the waterproofing patents of The A. C. Horn Company and the GF Waterproofing Products are made under those patents. To the trade, this statement is a sufficient guarantee and to others it can simply be said that these products have been recognized leaders for many years and that The General Fireproofing Company in the manufacture of waterproofings will adhere closely to these established formulas and absolutely maintain the high standard set by The A. C. Horn Company in years past.

Specification Guide

Substructural Waterproofing

Conditions	METHODS	Materials	Page
Seepage and Natural Soil Drainage,	1. Protect all masonry coming in contact with earth with—	GF No. 16	36
Dampproofing against:	2. Exterior masonry in contact with soil containing water other than that seeping through because of rain storm.		
	(a) Bituminous trowel coating.	GF No. 15	38
	(b) Waterproofed cement plaster.	GF No. 10	14
	3. If mass concrete—	GF No. 10	19
	Incorporate Waterproofing throughout mass.		
	4. If brick or stone—	GF No. 10	19
	Integral Waterproofing incorporated in mortar for all joints.		
Hydrostatic Head of Water in Conjunction with a Drainage System,	1. Envelope entire substructure with a Waterproof envelope.		
	(a) Bituminous trowel coating.	GF No. 15	38
	(b) Reinforced bituminous mat.	GF No. 17 and GF No. 18	28
Waterproofing against:	2. Waterproof by the integral method either as,		
	(a) Waterproofed cement mortar on walls applied either inside or out and as a top dressing on floors.	GF No. 10	16
	(b) Incorporate Waterproofing through entire mass of concrete	GF No. 10	19
	(c) Waterproof joints of brick or stone foundation walls.	GF No. 10	19
Heavy Pressure without Installing Drainage System,	1. Envelope entire substructure in a heavy, reinforced bituminous mat.	GF No. 17 and GF No. 18	29
Waterproofing against:	2. Incorporate Waterproofing through entire mass of concrete for wall and floor construction.	GF No. 10	19
	3. Incorporate Integral Waterproofing in mortar used in laying brick or stone.	GF No. 10	19

Specification Guide (Continued)

Conditions	METHODS	Materials	Page
Leaky Basements, Boiler, Elevator, Machinery or Other Pits, Repairing:	1. Apply a bituminous reinforcement to floors and side walls, protecting the floor Waterproofing with reinforced concrete, and the wall Waterproofing with masonry (either reinforced concrete or brick).	GF No. 17 GF No. 18	30
	2. Install a waterproof reinforced concrete floor slab and plaster wall surfaces with waterproof cement mortar.	GF No. 10	12

Dampproofing Above Grade

Conditions	METHODS	Materials	Page
Dampproofing on inside of masonry wall to be plas- tered directly to wall.	1. Coat the interior face of exposed walls with a Dampproofing coating.	GF No. 200	43
	2. For sealing angle, between ceiling and side wall.	GF No. 15	38
	3. Scratch coat of mortar to have Integral Waterproofing incorporated.	GF No. 10	19
Dampproofing in- terior of wall in connection with furring.	1. Coat entire interior face of exposed walls.	GF No. 200	43
	2. Trowel a plastic coating over entire interior face of exposed walls.	GF No. 15	39
	3. Seal angle between ceiling and side walls.	GF No. 15	38
	4. Apply on interior face of exposed wall coat of Waterproof Portland Cement Mortar.	GF No. 10	19
	5. When Porous Corrugated Tile construction is used, apply Dampproofing coating before plastering.	GF No. 200	43
Concrete, brick, stucco, or other masonry to be Dampproofed without affecting color or texture.	1. Waterproofing incorporated throughout mass of concrete.	GF No. 10	19
	2. Waterproofing incorporated throughout stucco coat.	GF No. 10	20
	3. Waterproofing incorporated throughout mortar used for laying brick or stone.	GF No. 10	19
	4. Coating concrete, brick, stucco or tile, so that neither color nor texture is changed.	GF No. 100	45
	5. Concrete and other masonry to be Dampproofed and beautified at the same operation.	GF No. 101	49

Specification Guide (Continued)

Conditions	METHODS	Materials	Page
Stainproofing patent plasters applied to tile.	1. Coat surface of porous tile with Stainproofing coating before applying plaster.	GF No. 200	43
Delicate stone to be protected against stains from backing.	1. Coat back and sides of stone with Stainproofing and Waterproofing coating. 2. Protect face of stone with an acid-proof, waterproof colorless coating.	GF No. 220 GF No. 145	40 54
Trim in contact with plastered surface or masonry, To be protected against stain:	1. Coat back of all trim with acid-proof and waterproof coating.	GF No. 200	43
Joints between window frames and brick or stucco walls to be Waterproofed.	1. Caulk space with plumbers oakum and cover with Waterproof Elastic Cement of same color as wall.	GF No. 250	51
Parapet walls and copings to be Waterproofed.	1. Plaster on inner side of parapet wall below coping. (a) Bituminous Trowel Coating.	GF No. 15	39
	(b) Waterproofed Cement Mortar.	GF No. 10	20
	2. Coating parapet with colorless Waterproofing.	GF No. 100	47
	3. Coating walls to make of one uniform color.	GF No. 101	49
	4. Imbed masonry and copings in Waterproof Mortar.	GF No. 10	19
Leaky brick, stucco or concrete walls, Remedying:	1. Coating walls with colorless Waterproofing.	GF No. 100	46
	2. Coating walls with colored coating to obtain desired color and Dampproofing at the same operation.	GF No. 101	49
Salt exuding. Wall remedying:	1. Coat with colorless Waterproofing.	GF No. 100	46
Interior of concrete or brick containers, Waterproofing:	1. Coat interior surface of container with colorless Waterproofing.	GF No. 100	46

Specification Guide (Continued)

Waterproofing—Floors and Roofs

Conditions	METHODS	Materials	Page
Floor construction Mills, Garages, Stables, etc., Waterproofing:	1. Wood floors of stables, mills, etc., waterproof with:		
	(a) Bituminous trowel coating.	GF No. 15	39
	(b) Reinforced bituminous mat.	GF No. 17-18	33
	2. Concrete floors of garages, mills, bathrooms, etc., waterproof with:		
	(a) Reinforced bituminous mat.	GF No. 17-18	33
	(b) Incorporate Waterproofing throughout floor construction.	GF No. 10	19
	(c) Incorporate Waterproofing throughout wearing surface.	GF No. 10	18
	3. Waterproof superficial wearing surface.	GF No. 140	52
Roof Waterproofing:	1. (a) Flat roof built up over concrete or boards.	GF No. 16-17 GF No. 18	32
	(b) Pitch roof—waterproof with plastic trowel coating.	GF No. 250	50
	2. Flat Tile Roof—Waterproofing underneath tile.		
	(a) Bituminous trowel coating.	GF No. 15	39
	(b) Heavy reinforced bituminous mat.	GF No. 17 GF No. 18	32
	c. Waterproofing incorporated in mortar joints of tile.	GF No. 10	19
	3. Concrete roof—flat or pitch.		
	(a) Trowel coating.	GF No. 250	50
	4. Steep pitch tile roof, Waterproofing:		
	(a) Waterproofing incorporated throughout mortar in joints.	GF No. 10	19
	(b) Trowel coating troweled in the joints.	GF No. 250	50
Bridge Floors, Waterproofing:	Membrane. Install heavy reinforced bituminous mat.	GF No. 17-18	34

Dustproofing, Finishing and Waterproofing Cement Floors

Conditions	METHODS	Materials	Page
Cement floor already dusting and subjected to ordinary traffic.	1. Use impregnating compound to Dustproof and still retain original color and texture.	GF No. 145	54

Specification Guide (Continued)

Dustproofing, Finishing and Waterproofing Cement Floors—(Continued)

Conditions	METHODS	Materials	Page
Cement floor to be laid and subjected to ordinary traffic.	2. Dustproofing by applying colored flat or gloss finishing coating.	GF No. 150	55
		GF No. 151	56
	1. Dustproofing by incorporating metallic hardening compound in final finish coat applied over the surface of the floor.	GF No. 140	52
Cement floor to be subjected to heavy traffic.	1. Incorporating through mass of top finish metallic hardening compound and applying drying coat containing 15-30 pounds to 100 sq. ft. of material before final troweling.	GF No. 140	52

Protective Coatings for Steel, Galvanized Iron, Etc.

Conditions	METHODS	Materials	Page
Steel in contact with masonry.	Applying to surface of steel a rust-resisting coating; protect with an alkali-resisting coating.	GF No. 300	59
		GF No. 325	60
Plastered surfaces to be decorated and made sanitary.	Coat surfaces with water-repelling and resisting paint.	GF No. 500	58

The Integral Method of Waterproofing.

GF No. 10.—Integral Waterproofing Paste.

The integral method of waterproofing is the simplest and, given the proper waterproofing materials, the most economical type. There are very few waterproofing problems which cannot be solved by this method and there is very little opportunity for improper application.

With just these advantages in view GF No. 10 Integral Waterproofing Paste has been compounded. GF No. 10 is a smooth white paste which is mixed with the gauging water when concrete or mortar is mixed. In GF No. 10 a set corrective agent is introduced in just sufficient quantity to neutralize the action of the other ingredients and, consequently, cement impregnated with this paste will set at the same rate as it would under ordinary conditions. Tests show conclusively that neither the tensile nor compressive strength is materially affected by the use of GF No. 10.

GF No. 10 has a distinct advantage over any other waterproofing paste on the market. It is absolutely soluble in water and will remain in suspension indefinitely. If proof is desired that this is the only paste which has this characteristic, simply read the instructions for using any of the others and note that invariably they state that after the paste has been dissolved in the water it must be stirred frequently. This is merely to stir up the insoluble part of their paste which must settle to the bottom or rise to the top. No GF No. 10 Paste will ever be found in the bottom of the barrel when the water is drawn off. GF No. 10, once dissolved in gauging water, gives a permanent, smooth and uniform mixture—no settling or no floating. This means a perfect distribution of the waterproofing paste wherever the water penetrates.

GF No. 10 Paste after its diffusion in the water, when mixed with the concrete, combines chemically with the constituents of the cement (lime and alumina), and forms a stable, water-repelling compound which thoroughly fills every void in the cement.

Briefly speaking, the features of GF No. 10 Paste which are of interest to every buyer of waterproofing are:

- First. Its absolute solubility in water, insuring uniform distribution throughout the mass.
- Second. Its chemical combination with cement to form a perfect and permanent waterproofing.
- Third. The simplicity of its application—reducing labor costs and eliminating any danger of imperfections due to careless workmanship.



FULLERTON-WEAVER APARTMENT HOUSE—635 Park Ave., New York City
 Architect—J. E. R. Carpenter. Contractor—Fullerton-Weaver Construction Co.
 Basement waterproofed with GF No. 10 Integral Waterproofing Paste

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A Test of GF No. 10.

The waterproofing value of GF No. 10 Integral Waterproofing Paste is well evidenced in the following letter from Robert W. Hunt & Co., of Chicago, giving the results of a test conducted on this material.

Robert W. Hunt & Co., Engineers

Chicago, March 5, 1914

General Fireproofing Company,
Youngstown, Ohio.

Gentlemen:

The following is a report of our construction and tests of a certain 18 in. concrete cube made with the addition of "GF No. 10 Integral Paste."

Construction of Cube

Under date of January 14th, we constructed a cube of concrete 18 in. square with a 2 in. pipe embedded in the center of it to a depth of 12 in.

This cube was made from a mixture of one part of Portland cement to two parts of Torpedo sand to four parts of crushed limestone ($\frac{3}{4}$ in. and under). In the mixing of the concrete the amount of water used was approximately 10 per cent of the total weight of the mixture. To the water had been added an amount of "GF No. 10 Integral Paste," which gave the equivalent of 17 pounds of "GF No. 10 Integral Paste" to a finished cubic yard of concrete.

Test of Cube With GF No. 10 Integral Paste.

After aging 28 days in air, a city water pressure of approximately 18 pounds per square inch was applied into the pipe for a continuous period of 15 days. During this period and under these conditions the cube did not show any signs of dampness whatsoever.

The cube was then subjected to an increase of pressure by means of a hydraulic pump as indicated in the tabulation below and which constitutes a log of the tests.

Log of Test

Pressure applied, pounds per sq. in.	Length of time pressure maintained, minutes	Observations
100	5	With no leaks whatsoever
200	5	With no leaks whatsoever
300	5	With no leaks whatsoever
400	5	With no leaks whatsoever
500	5	With no leaks whatsoever
600	5	With no leaks whatsoever
700	5	With no leaks whatsoever
800	5	With no leaks whatsoever
900	5	With no leaks whatsoever
1000	5	With no leaks whatsoever
1100	5	Base of cube opposite open end of pipe sweating at two locations.
1200	5	Base of cube dripping slowly at two locations and a third.
1300	5	Base of cube dripping slowly at three locations and a fourth one.
1400	5	Base of cube dripping slowly at ten locations.
1500	5	Base of cube dripping slowly from thirteen locations.
1600	?	It was impossible to hold 1600 pounds pressure on account of the dripping.

By rapid pumping a pressure of 1800 to 2000 lbs. per square inch was held for one minute when the pressure dropped suddenly to from 1200 to 1400 lbs. per square inch; it was held there approximately 4 minutes when the cube ruptured on two sides and the bottom. The sides of the cube did not show any signs of dampness up to the final failure. The top side showed dripping at five places near the pipe, probably due to the water backing up to the pipe and the surrounding concrete. The first of these leaks showed under the 1100 lbs. pressure.

Respectfully submitted,

ROBERT W. HUNT & CO.

General Directions and Quantities Required.

When the amount of cement to be used in the mix which is to be waterproofed has been determined, add to the water to be used in making this batch of concrete or plaster two per cent by weight of the cement of GF No. 10 Integral Waterproofing Paste. In other words, two pounds of GF No. 10 for every bag, or eight pounds of GF No. 10 for every barrel of cement used in making the mix. This is to be stirred into the water until it has thoroughly dissolved so that the water is of an even, milky color.

GF No. 10 Paste weighs eight pounds to the gallon and water weighs eight pounds to the gallon. As it is the accepted custom to use about 34 gallons of water for each barrel of cement used in making a batch of mass concrete to be poured, the proportion of paste to water would be 1-34. As there is usually about 17 gallons of water used to each barrel of cement in a batch of mortar for plaster coat work, the proportion of GF Paste to water would be 1-17.

After the Paste has once been brought into solution or thoroughly dissolved in the water by a thorough stirring, no further attention is necessary as the paste will, because of its nature, remain in suspension, neither rising to the top nor sinking to the bottom, but maintaining a perfectly even distribution throughout this water.

It is **not** necessary to stir the water every time you take out enough for a batch of concrete as the Paste, once dissolved in the water, **will not** settle or rise. This is because GF No. 10 Integral Waterproofing Paste is absolutely dissolved in water.

The cement mortar or concrete is to be wet, gauged or tempered with the milky solution thus obtained and the result will be, when the concrete has set, an absolutely water-tight mass.

Specifications for Waterproofing with GF No. 10 Integral Waterproofing Paste.

Conditions:

Waterproofing Against:

- A. Seepage and Natural Soil Drainage.
- B. Hydrostatic Head of Water in Conjunction with Drainage System.
- C. Hydrostatic Head of Water Without Drainage System.
- D. Concrete Floors of Mills, Garages, Stables, etc.
- F. Inner Face of Weather Exposed Concrete Surfaces.
- G. Brick Joints.
- H. Exterior Cement Plaster.

General Conditions:

To be Observed in all Types of Waterproofing Where GF No. 10 Integral Waterproofing Paste is Used.

Plastering over Masonry:

Wherever a waterproof plaster coat is to be applied to concrete or glazed terra cotta tile walls, the surface must be roughened with a mason's chipping hammer and

Specifications—Continued

treated with GF No. 400 Bonding Compound before any Waterproofing is applied. (See specification on GF No. 400 Bonding Compound.)

Wherever the plaster coat is to be applied over brick, the joints must be raked out to a depth of about one-quarter to three-eighths inches in preparation for the Waterproofing coat.

If the waterproof plaster coat is to be applied over porous tile, with corrugations for holding plaster, wash this surface clean and saturate it thoroughly with water before the plaster coat is applied.

Saturation:

All masonry surfaces are to be saturated with as much water as they will absorb before applying the cement grout necessary for holding the first waterproof plaster coat.

Proportion of GF No. 10 Integral Waterproofing Paste:

Always add GF No. 10 Integral Waterproofing Paste to the water to be used in mixing the concrete or plaster in the amount of 2 per cent by weight of cement used in individual mix to be waterproofed. If the batch to be waterproofed contains one barrel of cement, 8 pounds of GF No. 10 Integral Waterproofing Paste must be added to the water to be used in tempering or mixing this batch of concrete.

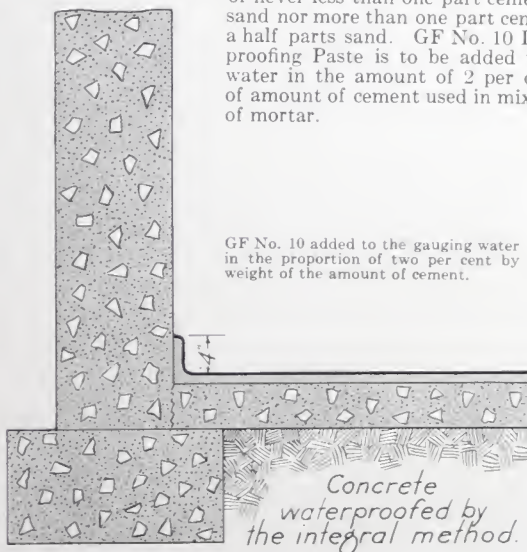
Materials:

GF No. 10 Integral Waterproofing Paste is manufactured by the General Fireproofing Company, Youngstown, Ohio, and is to be purchased direct from them or their authorized Agents. The paste must be brought to the building site in original and sealed packages. This paste must be used without adulteration and in accordance with the manufacturer's specifications and directions.

A. Mass Concrete. All concrete used in the (name part of work) is to be mixed in the proportion of one part cement, two parts sand and four parts aggregate. Or one part cement, two and a half parts sand to five parts aggregate.

In either case, GF No. 10 Integral Waterproofing Paste is to be added to the gauging water in the amount of 2 per cent by weight of amount of cement used in making each batch.

B. Plaster Coat. The mortar for waterproofed plaster coat is to be mixed of never less than one part cement to two parts sand nor more than one part cement to two and a half parts sand. GF No. 10 Integral Waterproofing Paste is to be added to the gauging water in the amount of 2 per cent by weight of amount of cement used in mixing each batch of mortar.



Specifications—Continued

Drainage and Leading Water from Surfaces to be Waterproofed:

Before actual waterproofing can be commenced it is necessary to drain away from the surfaces to be waterproofed any water which may be present. Provision must be made to keep this water out during the process and until the last section of Waterproofing is thoroughly set.

In case this necessitates the installation of a sump pit, either method No. 2, shown on page 17, or method No. 3 may be employed.

Method Number One

No. 1.—Where it is Possible Remove the Pressure and Water from the Outside of the Wall.

Where it is possible to have access to outer side of wall to be waterproofed a trench should be dug around all walls, this trench to go down as low as the footing course. This trench is to be pitched to a hole or ditch from which the water may be rapidly drained, so as to absolutely remove all pressure from walls and floor to be waterproofed.

All water pressure and all water must be kept away until the Waterproofing has set. After the Waterproofing has set thoroughly, the ditch and well or pit should be filled with broken stone or porous drain tile so as to leave them in condition to continue to relieve the pressure. After this has been done the back fill of dirt may be made.

Method Number Two

No. 2.—Draining Walls and Floors from the Inside to Relieve Water Pressure. (See Page 17.)

Around inside of all outside walls dig a trench, leading this trench to a sump pit or hole from which provision must be made to eject all water. The trench to be of sufficient width and depth to carry the volume of water coming through the walls and floors to the sump pit. This trench to be so designed that the upper level of the water is to be below the under side of the concrete underbed.

The bottom of the trench to be filled with broken stone or to have porous drain tile installed therein. The stone or tile to be covered with a layer of tarred felt or paper to prevent the subsequent layers of concrete from clogging the drain.

Method Number Three

No. 3.—Where a pressure is encountered on side walls which are to be covered on the inside with a plaster coat of waterproofed mortar, it may be necessary to bleed these walls with pipe drills. These "bleeders" are to be set at such intervals as to relieve all water pressure.

In case this condition is encountered it would be well to write The General Fireproofing Company, Youngstown, Ohio, for a complete set of specifications for the individual job in hand. It is impossible to cover this condition with a general specification. In asking for this information it is necessary to give The General Fireproofing Company all data as to water pressure encountered, height, length and thickness of surface to be waterproofed and the amount of space available for doing this work. All this data is necessary if we are to give you an intelligent specification and, possibly, a drawing showing the layout of the "bleeders."

Freeing Sump Holes of Water:

In cases where the sump hole is to be left open, provision must be made for keeping it free of water either by an automatic ejector or a steam pump.

Condition A—Seepage and Natural Soil Drainage.

Specifications for Waterproofing Masonry With a Waterproofed Cement Mortar Plaster.

This method of waterproofing is adaptable for foundations or other subsurface structures subject to seepage and dampness from surface drainage; for waterproofing standpipes, cisterns, reservoirs and swimming pools.

Specifications—Continued

Material:

Add, in proportion to each bag of Portland Cement used, 2 pounds of GF No. 10 Integral Waterproofing Paste to the water used for making the mixture.

Mixing:

The cement and sand are to be thoroughly mixed together, turning over the mass at least three times. Then the water used for tempering this mass, in which has already been dissolved the GF No. 10 Integral Waterproofing Paste, is to be added and the mixture thoroughly turned over until it is of even consistency.

The proportion of water necessary for mixing the amount of concrete plaster made with a barrel of cement for plaster work is usually about 17 gallons. As it takes 1 gallon or 8 pounds of GF No. 10 Integral Waterproofing Paste to waterproof the cement plaster made from a barrel of cement, the proportion of paste to water will be as 1 to 17.

Preparing Walls:

Before plastering the waterproofed cement on any masonry surface the latter should be roughened, using, if necessary, a mason's chipping hammer, and thoroughly cleaned with a wire brush; then treat the walls with GF No. 400 Bonding Compound mixed in the proportion of 2 pounds of GF No. 400 to a gallon of water. This solution is to be applied to the wall with a stiff bristle brush or a broom and after all chemical action has ceased the wall is to be washed down with several applications of clean water, using if possible a hose for this purpose. This will in most cases thoroughly saturate the wall, but if such is not the case more water should be applied to the surface until it will absorb no more.

Preparing Joint at Floor in cases where there is to be no Waterproofing over the Floor:

In case it is unnecessary to apply a waterproof plaster coat over the entire surface of the floor, a narrow gutter $2\frac{1}{2}$ inches by 3 inches should be cut down into the floor close up to the side wall, treated in the same manner as the side wall and filled with plaster which is to be trowelled out and up to an even surface with the surrounding flooring.

Application:

While the wall surface is still wet apply with a brush a thin coat of waterproofed neat cement and immediately thereafter plaster the first scratch coat of waterproofed plaster onto the wall. This coat should be thoroughly scratched and allowed to set for 12 hours or more until it is of sufficient strength to carry the second coat. The first coat should not exceed three-eighths of an inch in thickness and the total thickness of the two coats applied to the wall should not exceed three-quarters of an inch.

The scratch coat should be treated with a wash of waterproofed neat cement before the final coat is applied.

After the first or scratch coat has set sufficiently to carry the weight of the second coat this second coat is to be applied, floated free from all imperfections, using in this process the greatest pressure it is possible for the workmen to apply, and then finished to a smooth, even surface with a steel trowel.

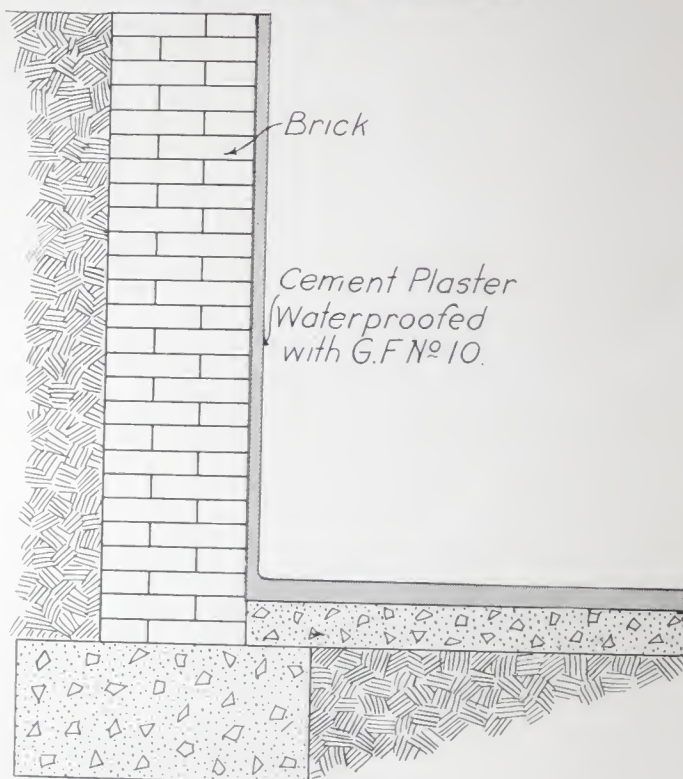
(Note: The more pressure exerted in finishing the final coat and the freer from voids the surface obtained, the better will be the result of the waterproofing.)

Top Finish Over Floors:

After all traces of grease, dirt and foreign matter have been carefully removed from the surface of the floor, this surface is to be thoroughly wetted and a coat of neat cement applied thereto. The waterproof mortar is to be applied in one coat to a thickness of $1\frac{1}{2}$ inches to 3 inches. After this mortar has obtained sufficient set, it is to be floated free from all imperfections and trowelled smooth, using a steel trowel and exerting as much pressure as possible to give a smooth, and even surface free from all imperfections.

(Note: The thickness of this slab must be designed to give sufficient weight of concrete to resist the pressure of water to be encountered.)

Specifications—Continued



Treating Joints:

Where it is impossible to work around the whole wall in one operation, the joints are to be treated as follows: After one section of the work is completed and before the next section is begun the joint is to be thoroughly wire brushed and treated with GF No. 400 Bonding Compound for the purpose of removing the cement film and exposing the aggregates before the next course of waterproofing is joined thereto.

Condition B—Hydrostatic Head of Water in Conjunction With Drainage System.

General Condition:

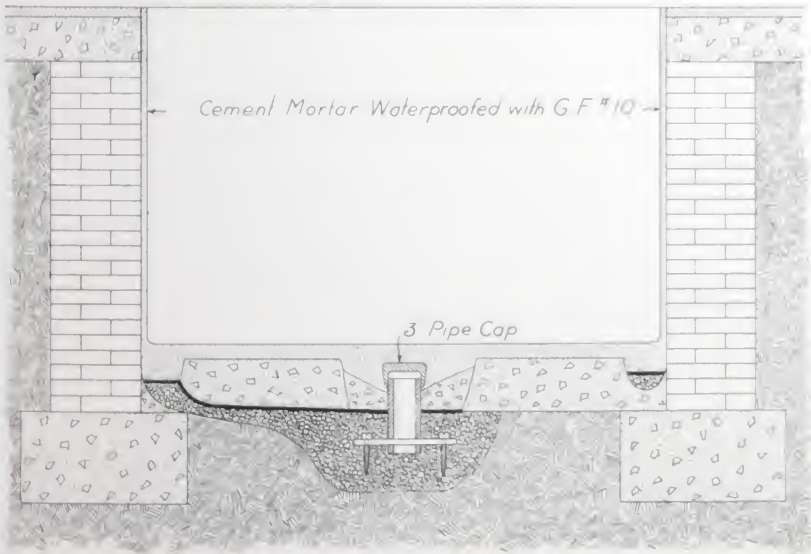
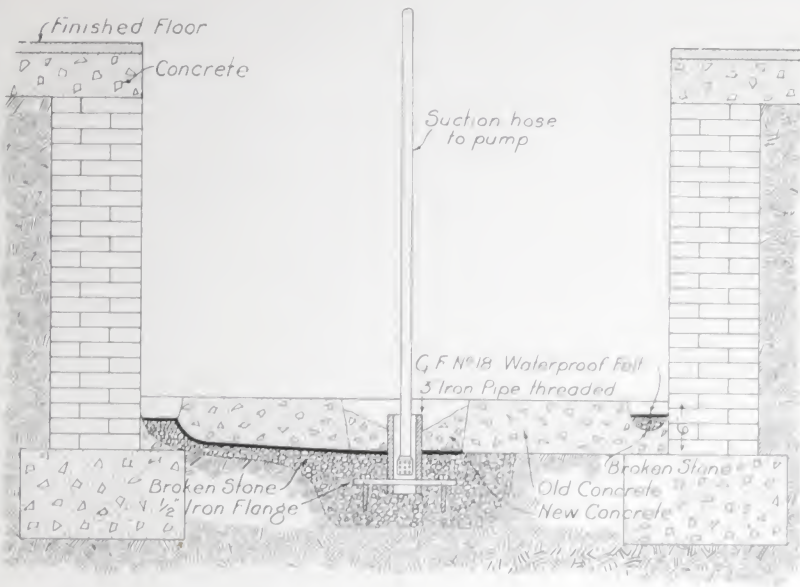
Before preparation for actual waterproofing can be commenced it is necessary to make provision for draining away all water from the surfaces to be waterproofed and keeping this water out during the process of waterproofing until the last section of the work is thoroughly set.

Preparation of Surfaces:

Surfaces are to be prepared as specified under general conditions.

Application:

The walls are to be plastered in same manner as specified under Condition "A."



Method of Waterproofing Leaky Basements under Heavy Pressure, without permanent Drainage Systems.

Specifications—Continued

Top Finish Over Floor:

The top finish over the floor is to be applied in the same manner as that specified under Condition "A," except that it is to be brought up to the edge of the sump and finished off with a rim which is to be made for the fitting of some type of cover over the sump hole.

Condition C—Heavy Pressure Without Drainage System.

How to Drain and Lead Water from Surfaces to be Waterproofed.

The same methods as those specified under Condition "B" are to be used.

Draining and leading water from surfaces to be waterproofed, where the specification just given is not sufficient to entirely relieve the wall of pressure.

Where such a pressure is encountered that the gutters along the floor are not sufficient to entirely relieve the side walls of pressure, bleeder pipes are to be inserted. The wall is to be drilled at frequent intervals and into these holes are to be driven pipes which are to come one-fourth of an inch or more below the surface of the finished waterproofing. Where this condition is encountered it is well to get special advice concerning the number and size of bleeder pipes that should be installed to give the best results.

Installing Pipe and Flange in Sump Hole:

The sump hole is to be of sufficient depth to keep the water level at the point farthest from this sump hole below the concrete slab present or to be installed. This sump hole to be equipped with an unpainted cast-iron pipe of sufficient diameter to take the suction pipe of the pump to be connected. The pipe installed is to have an iron flange at one end, with four holes with four 4-inch iron bolts through the holes, the object of these bolts being to hold the flange in place and prevent it from twisting and turning. The top end of the pipe to be threaded to take an iron cap which is to be placed in position when the process of waterproofing is completed. This pipe is to be set in the center of the sump hole, so that the top of the cap will be 1 inch below the surface of the concrete floor slab when same is finished. The bottom of this sump hole is to be filled with broken stone which is to be brought to a level to support the flange.

Preparation of Surfaces:

Surfaces are to be prepared in the same manner as specified under "A" and "B."

Wall Coating:

Walls are to be coated in the same manner as that specified under "A" and "B," except where bleeder pipes are needed. In cases where bleeders are used, special specifications will be furnished upon application to The General Fireproofing Company, Youngstown, Ohio.

Weight of Concrete to be Based on Water Pressure:

The thickness of the concrete slab to be used on the floor is based on the water pressure. You will find this information in tables shown on pages 24 and 25.

Top Finish Over Floors:

Before the top is applied over the floor, the cast-iron pipe in the sump hole is to be painted two thorough coats of GF No. 200, so that a perfect and water-tight joint may be made between the flooring and the pipe.

Apply over the floor a waterproof cement mortar top as specified under Condition "A," taking special care to make a thorough connection to the pipe in the sump hole and having the surface entirely free from foreign matter. After the cement plaster on the walls and the top finish on floor has completely set, remove the suction pipe, screw on the cap and cover the latter with cement plaster applied the same as that on the floors, weighing this waterproof mortar over the sump hole down, or preferably bracing it from above, for three or four days until it has had a chance to set.

Specifications—Continued

Condition D.

Specification for Waterproofing Mass Concrete used in Substructure Walls or Floors of Mills, Garages, Stables, Etc.

This treatment is also adaptable to deep foundation work, standpipes, cisterns, reservoirs, subways or other subsurface structures with a heavy hydrostatic pressure to be resisted.

Materials:

A dry mixture of cement, sand and stone is to be made, preferably of the proportion 1:2:4 or 1:2½:5, which shall be tempered with water to a quaking consistency to which water there has been added GF No. 10 Integral Waterproofing Paste so that the proportion shall be 8 pounds of paste to each barrel of cement or 2 pounds of paste to each bag of cement.

All concrete is to be placed in one continuous operation where possible. Each pouring is to be thoroughly spaded to insure uniform density in the wall or floor.

Joining New to Old Work:

Where joints are absolutely unavoidable, care must be taken to clean and roughen the old surface, treating it with GF No. 400 Bonding Compound to make sure of perfect adhesion of the new material to the old material. This Bonding Compound to be made as specified on page 57.

Curing:

The walls are to be allowed to cure the ordinary length of time before the forms are removed as GF No. 10 Integral Waterproofing Paste is so compounded that it neither accelerates nor retards the set of cement.

Condition F.

Waterproofing Inner Face of Weather Exposed Concrete Surfaces:

Use the same specification as under Condition "A" except that the drainage system may be omitted.

Condition G.

Waterproofing Joints of Brick or Stone Masonry.

A—Materials for Brick Walls:

The mortar to be made from Portland Cement in the proportion of one part cement and two and one half parts sand by volume. The water shall have added to it 2 per cent by weight of GF No. 10 Integral Waterproofing Paste (2 pounds of paste to each bag of cement used or 8 pounds or 1 gallon of paste to each barrel of cement used in making the mix).

Brick Not to be Laid in Freezing Temperature:

All brick shall be thoroughly wet just previous to being laid, except in freezing weather, when they shall be thoroughly dry. The brick shall be laid with full beds and joints properly and solidly bounded. No mason work of any description shall be built when the temperature is below 28 degrees F. on a rising temperature or 32 degrees F. on a falling temperature, at the point where the work is in progress. No frozen materials shall be built upon in any case.

B—Materials for Stone Wall:

All stone shall be laid on their natural bed. No stone which does not bond or extend into the wall at least six inches shall be used. Stones shall be firmly bedded in mortar of the same mixture as specified for brick wall and all spaces and joints shall be thoroughly filled with like mortar.

Specifications—Continued

Condition H.

Waterproofed Plaster Coat Applied on the Outside of Foundation Walls.

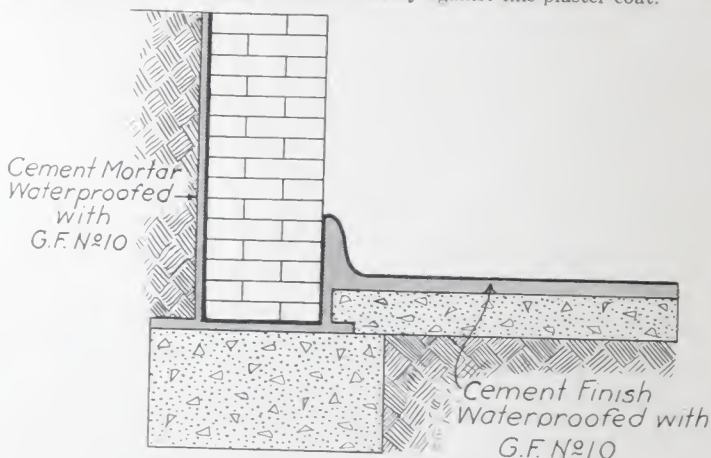
Where it is possible and desirable to obtain access to the outside of foundation walls for the purpose of waterproofing against dampness and seepage, hydrostatic pressure or any other condition, the work is to be done under the same general conditions as for work shown above and in accordance with design shown on this page.

Application:

After the walls have been prepared as herebefore stated and other conditions fulfilled a waterproofed plaster coat is to be applied over the whole wall from 4 inches above grade to the bottom of footings as shown in design on this page.

Back Fill:

After the second coat of waterproofed mortar has been applied and thoroughly trowelled up, the back fill may be made directly against this plaster coat.



Condition I.

Waterproofing Exterior Cement Plaster Stucco.

Materials:

Scratch coat shall consist of one part Portland Cement to 2½ parts clean sharp sand with a small amount of hair and only enough lime paste to insure a smooth working mortar (preferably about 1/10 by volume). To the water used in mixing this plaster shall be added 2 per cent by weight of the cement of GF No. 10 Integral Waterproofing Paste.

Final Coat:

The finish coat shall consist of one part cement, two and a half parts of clean sharp sand or two parts of sand and 2 per cent of GF No. 10 Integral Waterproofing Paste added to the tempering water in proportion to the volume of cement used in making the mix.

Waterproofing Paste:

The GF No. 10 Integral Waterproofing Paste shall be that manufactured by the General Fireproofing Company, Youngstown, Ohio, and purchased from them or their authorized Agents and shall be used in accordance with their directions.

Specifications—Continued

Stucco Over Metal Lath:

The scratch coat shall be prepared as specified above and shall be thoroughly trowelled so as to form a perfect key to the lath. After it has set sufficiently it shall be thoroughly scratched to form a key for the finish coat, which shall be applied so as to bring the total thickness outside of the lath up to 1 inch.

Stucco Over Masonry:

When plastering over a masonry surface care must be taken to have such surface roughened as specified herebefore, using a mason's chipping hammer, if necessary, to obtain the desired result.

Where the stucco is being applied over a specially prepared masonry surface, such as corrugated hollow tile or a brickwork already set with raked joints, chipping is not necessary.

Saturate all masonry surfaces over which stucco is to be applied with as much water as the walls will absorb, applying the first coat of cement stucco directly upon the surface while the latter is very wet.

Condition J.

Break or Opening in Surfaces Where Concrete is Waterproofed by the Integral Method.

Sometimes a break occurs in a wall or floor that has been waterproofed by the Integral method, either in the mass or by a plaster coat because of settlement of the building, defective workmanship, the removal or placing of pipes, or external damage.

If the break or opening is large, admitting either a single large stream or several small streams of water, remove the entire area of the affected surface to a depth of three-quarters of an inch, leaving the surface rough.

After the surface has been treated with GF Bonding Compound, as specified herebefore, proceed to do what is known as "bleeding the surface." Provide several pieces of one-quarter inch iron pipes 2 or 3 inches in length and drive one piece into the surface wherever water enters, leaving the end projecting about one-quarter inch beyond the rough surface. After the pipes are all placed the water will cease percolating, generally entering only through the pipes. Treat the whole surface with one or two liberal applications of GF No. 400 Bonding Compound.

After the wall is thoroughly saturated and cleaned of the Bonding Compound apply over the whole of the affected area two coats of Portland Cement Mortar waterproofed with GF No. 10 Integral Waterproofing Paste finishing the surface flush with the old adjoining surface in the same proportions of mortar as specified under Condition "A."

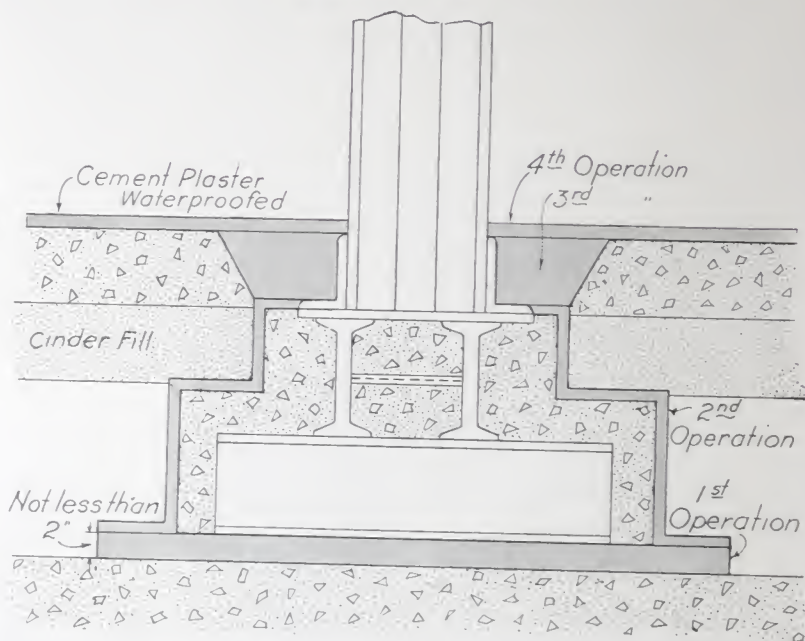
After this coating is thoroughly set and dry, plug up the ends of the "bleeders" (pipes) with a piece of wood driven in tight. Then cover with cement mortar waterproofed with GF No. 10 Integral Waterproofing Paste, connected to the adjoining cement plaster coating.

Only two of the "bleeders" are to be plugged daily, working from the outside to the center of the space, allowing sufficient time for the newly applied plaster coating to set hard before closing any more "bleeders." The last "bleeder" is plugged and waterproofed in the same manner as the others and immediately covered with wet straw boards firmly braced and kept so until the plaster coating has set.

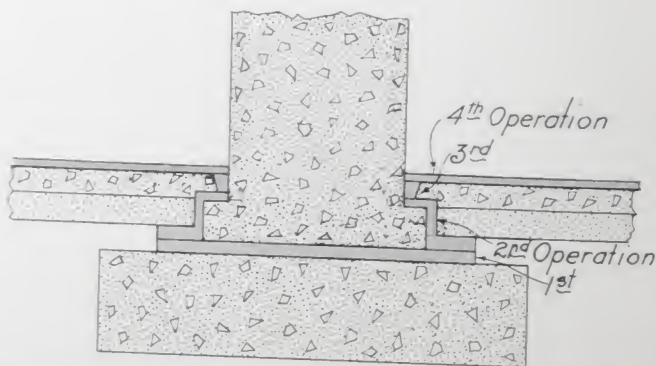
If the break or opening is small, clean the surface of all loose particles of cement, dirt, etc., and treat with a liberal application of GF No. 400 Bonding Compound. Apply over this surface a coating of Portland Cement Mortar waterproofed with GF No. 10 Integral Waterproofing Paste and thoroughly scratched, over which is to be applied a second coat of Portland Cement Mortar waterproofed in the same manner working both coats well into the edges of the old plaster coating. After this is done cover immediately with wet straw boards firmly braced in position and kept so until the plaster coat has set.

If this leak or opening takes the form of a long crack and there is considerable water coming through it, the best method to pursue is to cut an inverted key into the wall, treat the sides of this key with GF No. 400 Bonding Compound and then fill key full of mortar waterproofed with GF No. 10 Integral Waterproofing Paste as specified for other plaster coat work. After this mortar has been tamped in as firmly as possible it is to be braced with straw boards which are to be kept in position and wet for several days until the mortar has had a chance to set thoroughly.

System of Waterproofing Column Footings With GF No. 10.



Waterproofing Steel Column Footing and Grillage with GF No. 10



Waterproofing Footing for Concrete Column with GF No. 10. Above methods used in Ward Bakery Building, Orange, N. J.

GF No. 11 Integral Waterproofing Powder.

Some architects using the Integral method of waterproofing prefer a powder to be mixed with the cement instead of a paste to be used with the water, and to meet this demand GF No. 11 Integral Waterproofing Powder has been compounded. It must always be borne in mind that the success of any powder for this purpose depends on its thorough, uniform mixture.

GF No. 11 Integral Waterproofing Powder is practically the same product which is formed in the cement when GF No. 10 Paste combines with constituent parts of the cement—the powder is a pre-formed waterproofing whereas the waterproofing qualities of the paste are only complete after it is put in use.

The GF No. 11 Powder being of much lower specific gravity than cement will necessarily find and fill the voids, and the powder itself, being perfectly water-repellant, will keep out all moisture.

This powder is combined with a set corrective which insures that the cement will set identically the same as though the powder were not used. The fact that all chemical combinations to form this waterproofing have taken place in the manufacture of this powder means that its action in waterproofing is chiefly mechanical, and this is why care must be taken to see that it is thoroughly mixed with the cement so that every void will be filled.

GF No. 11 is not affected by heat and it is well to remember that excessive heat will often destroy the waterproofing element of a compound which is not prepared to resist it properly.

General Directions and Quantities Required.

GF No. 11 Integral Waterproofing Powder is to be added to Portland Cement in the proportion of two pounds to each bag of cement or eight pounds to each barrel used in any mixture. These two are to be thoroughly mixed dry so as to insure complete distribution of the GF Powder. Add this mixture to the sand, which should never be less than two parts nor more than two and a half parts by volume, the whole to be manipulated until the mass is evenly mixed and uniform in color. In case of mass concrete this mixture is to be added to the aggregate and thoroughly turned over at least three times.

Mass Concrete

MIXTURES	CEMENT REQUIRED	GF No. 11 POWDER
	per cu. yd.	per cu. yd.
1 : 2 : 4	1.52 bbls.	12 16 lbs.
1 : 2½ : 5	1.26 bbls.	10.08 lbs.

Cement Mortar

PROPORTIONS	THICKNESS	BBLs. OF CEMENT	GF No. 11 PASTE
		per 100 sq. ft.	per 100 sq. ft.
1 part cement	1 inch	1	8.0 lbs.
2 parts sand	¾ inch	.75	6.0 lbs.
	¾ inch	.625	5.0 lbs.
1 part cement	1 inch	.83	6.64 lbs.
2½ parts sand	¾ inch	.63	5.04 lbs.
	¾ inch	.52	4 16 lbs.

Resisting Properties of Reinforced Concrete in Walls and Floors

In reinforcing concrete floors the reinforcing steel is placed so as to resist tensional stresses, whereas the concrete which is weak in tension, is designed to resist compression stresses.

In the floors of a building the loads come upon the upper surface of the floor slabs. Therefore the reinforcing steel is placed near the under side of the slab.

Where basement floors are designed to resist water pressure against the bottom of the slab the position of the reinforcing steel is reversed, i. e., is placed near the top of the slab.

To find the pressure exerted by a given head of water for walls multiply the head in feet by 31.25 lbs.; for floors multiply by 62.5 lbs. Thus: A ten-foot head of water would exert a pressure of 312½ lbs. per square foot on a wall surface or 625 lbs. per square foot on a floor.

Explanation of Table of Resisting Properties of Concrete Slabs

The table of RESISTING PROPERTIES OF CONCRETE SLABS on the opposite page gives the total thickness of slab and the amount of reinforcing steel required for various water pressures and spans. It also shows the effective depth of slab or the distance from the water face to the center of the reinforcing steel.

This table considers reinforcing steel placed in one direction only.

EXAMPLE

Consider as a slab a section of wall with buttresses or supports 12 feet apart and on the other side of this wall water 10 feet deep.

For walls we find that a 10-foot head of water exerts a pressure of 312.5 pounds on every square foot of surface.

Find the span 12 feet (the distance between buttresses) in the "Clear Span in Feet" column of the table of RESISTING PROPERTIES OF CONCRETE SLABS. Opposite this and on the same horizontal line, we find under the vertical column of "Total Thickness of Slab" that a 13-inch slab is good for 388 pounds per square foot. As the actual pressure exerted is only 312.5 pounds per square foot, this slab can be used with safety.

In the same vertical column and opposite "Sectional Area of Steel per foot of Width" we find that .99 square inches of reinforcing steel is required per foot of width of slab.

In the same vertical column and opposite "Effective Depth of Slab" we find that this steel must be placed 11 inches from the water face of the wall.

Explanation of Table of Resisting Properties of Concrete Basement Floors

In reinforcing basement floors against a water pressure the reinforcing steel MUST be placed NEAR THE TOP of the slab.

The table of RESISTING PROPERTIES OF CONCRETE BASEMENT FLOORS on the opposite page shows the total thickness of slab, the amount of reinforcing steel required, the effective depth of slab and the distance from the water face of the slab to the center of the reinforcing steel.

This table considers reinforcing steel placed in one direction only.

EXAMPLE

Consider a basement floor having a span of 20 ft. 0 in. which is to resist a pressure equal to a column of water 5 ft. 0 in. above the bottom of the floor.

The lifting power of a column of water 5 ft. 0 in. high is 312.5 pounds per square foot.

Find the span 20 ft. 0 in. (the distance between bearings) in the column "Clear Span in Feet" in the table of RESISTING PROPERTIES OF CONCRETE BASEMENT FLOORS. Opposite this and on the same horizontal line we find under the column of "Total Thickness of Slab" that a 16 in. slab is good for 321 pounds per square foot. As the actual lifting power of a 5 ft. 0 in. column of water is only 312.5 pounds per square foot, this slab may be used with safety.

The resisting properties of slabs as given in the table of RESISTING PROPERTIES OF CONCRETE BASEMENT FLOORS include the weight of the slab.

Resisting properties of Concrete Slabs

Total Thickness of Slab	4'	5'	6'	7'	8'	10'	11'	12'	13'	14'	15'	16'	17'	18'	20'	
Effective Depth of Slab	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	18'	
Stress in Steel 16000 $\frac{\text{lb}}{\text{sq. in.}}$ " " Concrete 640 " "	3	507	1102	1745	2526	3454	4525	5663	7150							3'
	4	220	594	950	1304	1902	2495	3183	3950							4'
	5	185	357	522	686	1174	1555	1983	2465							5'
	6	114	228	380	563	784	1037	1358	1760	2038	2445	2905	3360	3855	4425	5650
	7	70	152	260	389	551	735	946	1190	1456	1750	2073	2420	2786	3200	4100
	8	42	101	181	276	396	532	693	872	1076	1300	1556	1800	2066	2395	3060
	9	23	67	127	196	289	393	520	636	820	1000	1166	1392	1613	1855	2390
	10		42	89	142	215	295	395	507	633	773	925	1090	1268	1455	1801
	11		24	61	100	159	221	302	390	490	603	726	861	1008	1155	1508
	12			39	70	118	167	235	305	380	483	583	694	800	945	1230
	13				22	54	84	123	177	230	305	385	468	560	660	776
	14					26	58	90	147	185	243	307	378	455	538	635
	15						37	61	99	140	190	245	305	376	443	520
	16							39	69	105	148	195	248	300	365	435
	17								47	76	112	150	195	245	295	355
	18									26	53	83	115	155	196	245
	19										31	58	85	119	155	198
	20											36	61	90	121	157
	21												39	63	92	123
	22													41	65	93
	23														23	45
	24															23
Weight of slab per sq ft.	50	63	75	94	106	125	137	150	162	175	187	200	212	225	250	
Sec't Area Steel per ft width	.27	.36	.45	.57	.65	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.62	

Resisting properties of Concrete Floors

Total Thickness of Slab	4'	5'	6'	7'	8'	10'	11'	12'	13'	14'	15'	16'	17'	18'	20'	
Effective Depth of Slab	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	18'	
Stress in Steel 16000 $\frac{\text{lb}}{\text{sq. in.}}$ " " Concrete 640 " "	3	557	1165	1820	2620	3560	4650	5800	7300							3'
	4	270	627	1025	1478	2008	2610	3300	4100							4'
	5	235	420	637	940	1260	1680	2120	2615							5'
	6	164	291	455	637	890	1162	1475	1820	2200	2620	3090	3560	4100	4650	5900
	7	120	215	335	485	637	860	1083	1340	1620	1925	2261	2620	2998	3425	4350
	8	92	164	254	370	502	637	830	1022	1238	1475	1725	2080	2360	2620	3310
	9	73	130	202	290	395	518	637	806	982	1175	1375	1592	1825	2080	2690
	10		105	164	236	321	420	532	637	795	988	1112	1290	1480	1680	2151
	11		87	136	194	265	346	439	540	652	776	913	1061	1220	1383	1758
	12			73	114	164	224	292	370	455	550	658	770	894	1012	1170
	13				97	140	190	240	314	388	470	560	655	760	872	995
	14					120	164	215	284	335	405	482	565	655	750	860
	15						104	143	186	236	290	352	420	492	570	655
	16							125	164	206	255	310	370	435	500	577
	17								145	184	226	274	325	382	445	510
	18									165	203	245	290	342	396	455
	19										181	220	260	306	355	410
	20											198	236	277	321	369
	21												214	250	292	335
	22													226	265	305
	23														243	280
	24															223
Weight of slab per sq ft.	50	63	75	94	106	125	137	150	162	175	187	200	212	225	250	
Sec't Area Steel per ft width	.27	.36	.45	.57	.65	.72	.81	.90	.99	1.08	1.17	1.26	1.35	1.44	1.62	

GF No. 17 Mop Coating and GF No. 18 Waterproof Felt.

Where a considerable water pressure is encountered in waterproofing substructural work, if it is not practicable to install a permanent drainage system with automatic pump to carry the water off, it becomes necessary to erect a heavy waterproof mat. This must be, in turn, held in place with sufficient concrete, plain or reinforced, to offset the outside water pressure. For example: An eight-foot head of water will exert a pressure of 500 pounds per square foot. The waterproof mat to be installed has practically no structural strength in itself to resist this pressure and consequently a concrete slab or a brick retaining wall heavy enough to resist a pressure of 500 pounds per square foot must be used in this case in conjunction with the mat itself.

GF No. 17 Foundation Mop Coating is a compound with a bituminous base, especially prepared for this method of waterproofing. It is absolutely free from those elements so often found in compounds for this purpose—residium oils, resin, etc.—and which in themselves have no permanent waterproofing value, but on the other hand have a tendency to disintegrate under water, or are brittle and will not respond to expansion and contraction.

GF No. 17 will remain pliant in zero weather and will not run or slide at 110 degrees Fahrenheit; it is not affected by water, by a 20 per cent solution of ammonia, by hydrochloric or sulphuric acids, or by a saturated solution of sodium chloride.

GF No. 17 must be melted before using and applied hot. In cold weather the surface should be previously coated with GF No. 16 Foundation Brush Coating, and in fact it aids in saving of material and helps in bonding in all cases.

GF No. 18 Waterproof Felt is built up to be used in connection with GF No. 17 in the type of waterproofing above described. This felt is in itself waterproof—made from wool stock felt containing a mixture of linen and wood fiber to give it greater tensile strength. In the manufacture of this felt it is saturated with a bituminous compound especially prepared for this purpose. It is elastic, waterproof, acid- and alkali-proof. It adds to the strength of the felt, makes it tough and yet leaves it sufficiently pliant to prevent its cracking even under extreme temperatures. This saturation occurs in the process of manufacture and while many so-called saturated felts are merely run through a hot bath of asphalt, every fiber of GF No. 18 Waterproof Felt is saturated thoroughly as well as coated.

The covering capacity of GF No. 17 as applied with GF Waterproof Felt varies only with the thickness of the coat.

A coating $1\frac{1}{16}$ inch thick covers 26 square feet to the gallon.

A coating $1\frac{1}{24}$ inch thick covers 38 square feet to the gallon.

Specifications for Waterproofing with GF No. 17 Mop Coating and GF No. 18 Waterproof Felt.

Materials:

GF No. 17 Mop Coating and GF No. 18 Waterproof Felt, as manufactured by The General Fireproofing Company, Youngstown, Ohio, are to be purchased direct from the manufacturers or their authorized Agents, and to be delivered on the building site in original and sealed packages.

General Conditions:

The Waterproofing course to consist of three ply or layers (or as many ply as may be necessary for particular work in hand) of GF No. 18 Waterproof Felt and four ply or coatings of GF No. 17 Mop Coating applied hot. This Waterproofing course to be carried across all footings, both interior and exterior, under all floors and partitions, including the side walls and floors of any and all pits, and up all walls in contact with the ground to grade level.

After the Waterproofing course has been completed it is to be protected with a plaster coat of mortar at least 1 inch thick to protect it against possible abrasion. This must be done in every case.

Preparing Angles:

To prevent the danger of breaking the Waterproofing course, Waterproofing shall not be applied to right angle surfaces, such as the junction between floors and walls, before such angles are sloped or coved with cement to form a firm and even bed for the application of the Waterproofing. Before applying the Waterproofing over a right angle corner of brick or concrete masonry, the corner shall be chipped off and smoothed up with cement mortar to give a round turn.

Method of Application:

If Either GF No. 15 Foundation Trowel Coating or GF No. 16 Foundation Brush Coating are to be Used Before the First Mop Coating is Applied:

First: After the masonry surface has been thoroughly dried and cleaned of projections and foreign matter an under coating of GF No. 15 or 16 is to be applied over the entire surface to be waterproofed. After this coat of GF No. 15 or GF No. 16 has thoroughly set the surface is to be thoroughly swabbed with a good even coat of GF No. 17 applied at such a degree of heat that it does not lump but spreads evenly over the surface. Then a layer of GF No. 18 Felt is to be immediately embedded in this hot coating and carefully pressed down so that there are no wrinkles or ridges.

Then proceed as hereinafter specified with the second swabbing.

Where the GF No. 17 Mop Coating is to be Applied Directly to the Surface of the Masonry:

First: After the masonry surface has been thoroughly dried and cleaned of projections and foreign matter, the surface is to be thoroughly swabbed with a good even coat of GF No. 17 applied at such a degree of heat that it does not lump when it comes in contact with the cold masonry but spreads on smoothly; then a layer of GF No. 18 Felt is to be immediately embedded in this hot coating and carefully pressed down so that there are no wrinkles or ridges.

Second: Swab this layer of Felt with a thorough coating of GF No. 17, then lay another thickness of GF No. 18 Felt over the full width of the sheet already placed, then mop this thoroughly with another coating of GF No. 17.

Third: Lay another layer of GF No. 18 Felt the full width of those already laid and mop this again with GF No. 17.

Fourth: The next layer of Felt is to be lapped over two-thirds of its width over the preceding layers of Felt already laid and is to be mopped in the same manner.

Fifth: The next layer of Felt is to be lapped over two-thirds of its width over the preceding layer of Felt just laid and is to be mopped in the same manner.

This method of procedure is to be continued until the whole surface is covered. After the entire surface to be waterproofed has been covered, all flashings and joints made, the entire top surface of the Felt is to receive a thick mop coating of the GF No. 17 applied hot.

Application of Four Ply or More:

With the exception of the direction of the layers, the preceding directions for application are to be followed. Where four plies are to be used, the best method is to lay two plies and two plies at right angles; where five plies are to be used, three plies and two plies at right angles; where six plies are to be used, three plies and three at right angles.

Protection of Waterproofing Course:

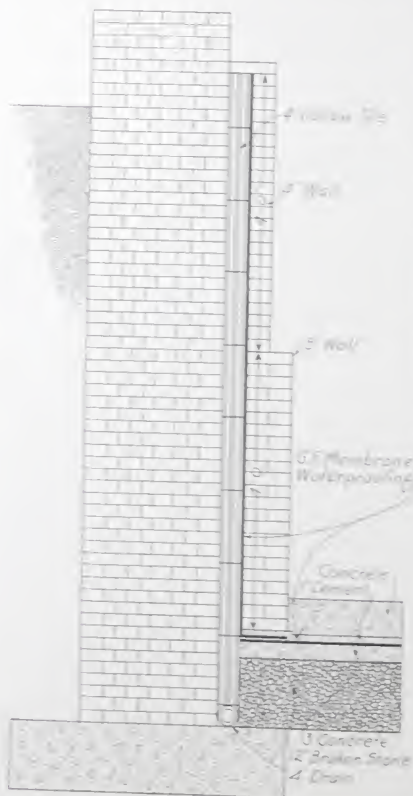
After the Waterproofing course over the floor has been finished it shall be protected with a 1-inch thick plaster coat of 1-2 cement mortar applied directly over the last swabbing of GF No. 17.

Condition No. 1.

Waterproofing Against Hydrostatic Head of Water in Conjunction With a Drainage System.

Drainage System:

Sufficient drainage gutters or hollow tile drains must be installed to lead out all water. The drainage gutters or hollow tile drains must all lead to a sump pit in which is installed an automatic or steam pump for the purpose of ejecting the water drained to this pit.



Application:

After all water has been removed and the surfaces thoroughly dried in accordance with the general conditions, a Waterproofing course to consist of (?) plies of GF No. 17 and GF No. 18 Waterproof Felt (dependent on pressure) is to be installed as specified under "Method of Application."

The Waterproofing is to be carried across the footings over a key with 6-inch laps on either side to which floor and wall Waterproofing is to be connected. After the wall Waterproofing has been finished up to the desired height, a lap of 4 inches is to be left so that the Waterproofing may be turned back into the wall 4 inches at grade level to prevent water seeping in over the top of the Waterproofing. (See sketch, page 29.)

Specifications—Continued

Condition No. 2.

Heavy Pressure Without the Installation of Drainage System
to be Waterproofed Against.

Drainage System:

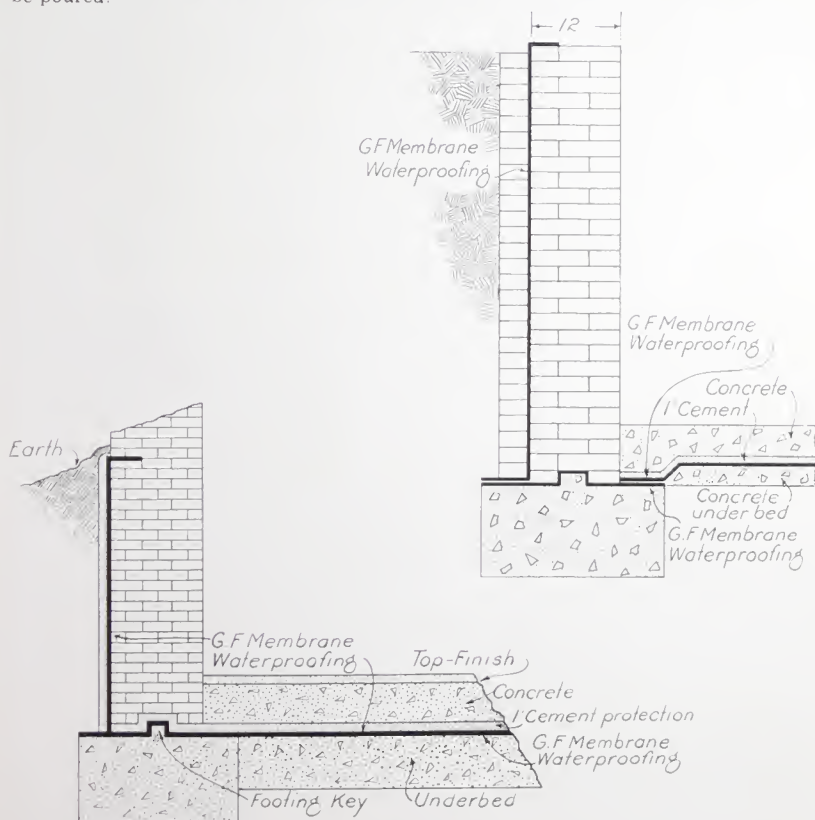
Before waterproofing operations are commenced, the drainage gutters and pumps must be installed to take care of all water and leave the footings and side walls absolutely free from dampness.

Application:

The Waterproofing to be carried across the footings over a key with 6-inch laps on either side to which the wall and floor Waterproofings are to be connected.

Protecting Wall:

Before the protecting wall is laid a 1-inch coat of cement plaster must be applied over the entire course of Waterproofing. In laying the protecting wall, great care is to be taken not to injure the Waterproofing and all joints of the brickwork are to be well filled with mortar, having the latter rather wet and using a shove joint. If it is possible to do so, an opening should be left between the protecting coat of cement mortar and the brickwork into which a thin grout of Portland Cement and sand should be poured.



Specifications—Continued

Condition No. 3.

Leaky Basement, Boiler Pit or Elevator Pit to be Water-proofed After the Building Has Been Completed.

Wall Construction:

First: Build an outer wall 12 inches thick and three feet in height; then set back from the inner face 4 inches and build 3 feet more of wall; then set back again from the inner face 4 inches and build 3 feet more in height. All the angles formed by the setting back are to be rounded off and coved up with cement mortar as heretofore specified, so as not to break the Waterproofing course in making the turns.

Second: Then apply a sufficient number of ply of Waterproofing to the inner face of the wall, extending it across the full width of the footing on the inside and carrying it out across the full width of the wall at the top.

Third: Protect the Waterproofing with a 1-inch plaster coat as heretofore specified and build against this a wall of the same height as that already built, with the necessary additional brickwork to bring the wall to the required thickness.

Fourth: Bring the lap of the Waterproofing across the top of the wall to the inner edge.

Fifth: On top of the wall already built, build an outer wall 12 inches thick, 3 feet in height as before; then step back 4 inches and build 3 feet; step back again 4 inches and build 3 feet.

Sixth: Connect the lap of Waterproofing left at the base of this second wall and extend it up the inner face of the second piece of wall after the angles have been coved and rounded and lap on top as before.

Seventh: Then build the additional thickness of wall necessary to resist the pressure against the Waterproofing and extend the lap across the entire wall.

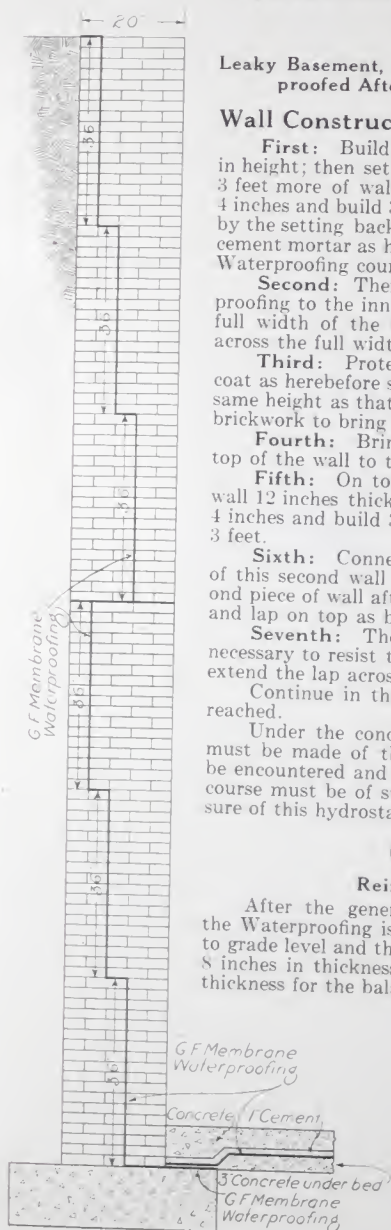
Continue in this manner until the full desired height is reached.

Under the conditions mentioned, a careful computation must be made of the greatest hydrostatic pressure that will be encountered and the wall on the inside of the Waterproofing course must be of sufficient strength to resist the entire pressure of this hydrostatic head.

Condition No. 4.

Reinforced Bituminous Mat.

After the general conditions have been complied with, the Waterproofing is to be carried up the inner face of walls to grade level and then protected by retaining walls of masonry 8 inches in thickness for one-half the height and 4 inches in thickness for the balance of the height of the wall.



Specifications—Continued

Condition No. 5.

Waterproofing Around Columns and Under Grillages.

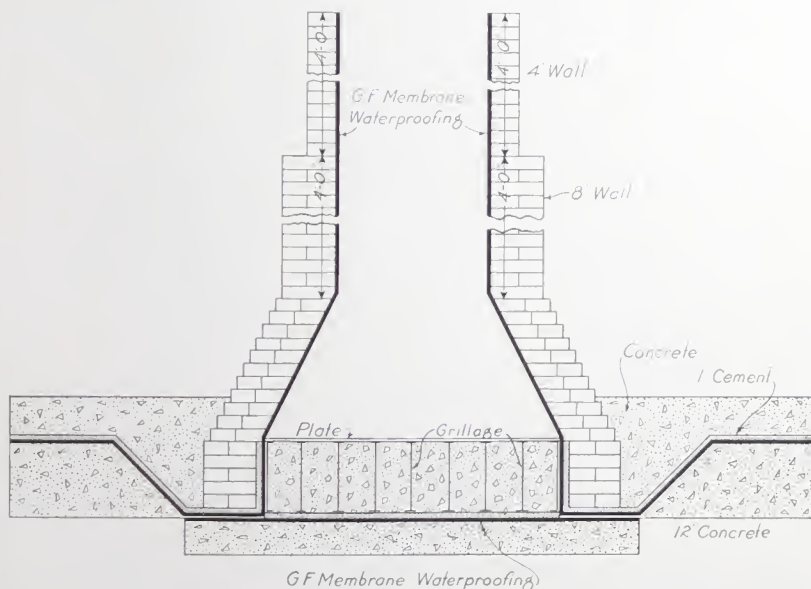
Waterproofing Course.

After the surface to be waterproofed has been prepared in accordance with the suggestions under "Method of Application," and before the grillages are set, a sufficient number of plies of Waterproofing to resist the hydrostatic pressure are to be laid on the bed where these grillages are to set, extending the Waterproofing out over the full size of the column footing. The whole layer of Waterproofing is to be thoroughly protected with a 1-inch coat of Portland Cement Mortar.

After the columns are set the shoes are to be filled solid with Portland Cement grout, the rivet heads plastered over even and smooth and the underbed of floor concrete to be properly smoothed and graded with Portland Cement. Then lay the Waterproofing over the floor connecting it to the lap under the grillages and extending the Waterproofing up the columns to the desired height above the floor (which should be at least 12 inches above the highest water level).

Protecting Brickwork:

Then build protecting brickwork against the Waterproofing around the column at least 8 inches in thickness for the first four feet in height and 4 inches in thickness for the balance. After this work is completed the finish course of concrete may be laid over the entire floor.

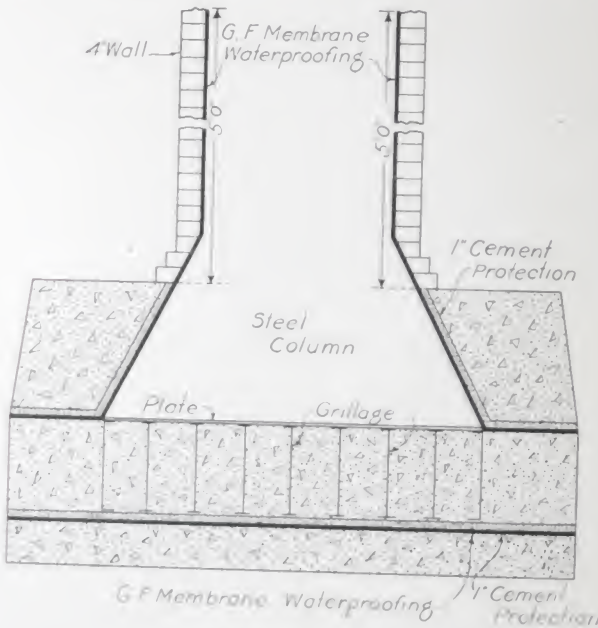


Specifications—Continued

Condition No. 6.

Waterproofing Around Columns.

After the underbed of floor concrete is properly graded and smoothed off with Portland Cement Mortar and the rivet heads are all plastered, the Waterproofing is to be laid over the entire floor extending same up columns to a height of 2 to 5 feet (if necessary to extend higher, system previously mentioned should be used), protecting the same with 1 inch of Portland Cement Mortar. Then build 4 inches of brickwork against Waterproofing of columns and lay finish course of concrete over the entire floor.



Condition No. 7.

Built-Up Roofs Over Concrete, Wood or Flat Tile Roofs.

A. Concrete Roof. The surface of a concrete roof over which Waterproofing is to be applied should be smoothly graded with Portland Cement Mortar leaving no depressions or rough spots. Over the entire surface lay four plies of GF No. 17 Mop Coating and GF No. 18 Waterproof Felt. This is to be laid in alternate plies, giving four plies of GF No. 18 Felt and five plies of GF No. 17 Mop Coating.

B. Wood Roofs. Where Waterproofing is to be laid over the surface of wood roofs, the surface of the wood should not be coated but covered with a layer of building paper lapped at least 2 inches and every lap nailed with roofing tins and nails 6 feet apart.

C. Slag or Gravel. In either case where the finish of the roof is to be of slag or gravel it is to be applied at the same time as the final coating of GF No. 17. The GF No. 17 to be applied thickly, pushing into it as much as possible of the slag or gravel, in any case not less than 400 pounds of slag or 500 pounds of gravel per square. The gravel or slag, whichever is used, must be perfectly dry. If necessary heat it to attain this result.

Specifications—Continued

D. Tile. In case tile is to be laid over the Waterproofing, a bed of cement mortar not less than 1 inch in thickness waterproofed with GF No. 10 Integral Waterproofing Paste should be laid over the final coating of GF No. 17 and into this the tile should be embedded, bringing them up to a true and even surface. The joints between the tile are to be one-quarter inch in width and filled with Portland Cement Grout waterproofed with GF No. 10 Integral Waterproofing Paste.

Expansion Joints. If expansion joints are required, they should be not less than 1 inch in width and be filled with GF No. 250 Mastic Cement.

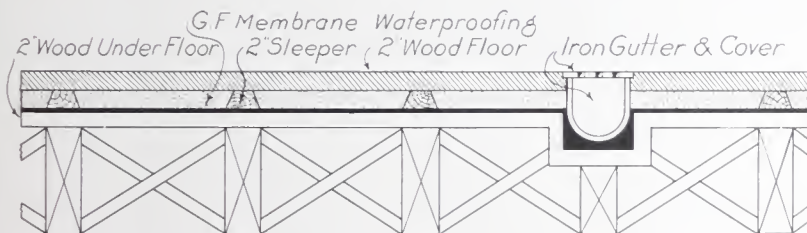
Condition No. 8.

Floor Construction of Mills, Garages, Stables, etc., to be Waterproofed Under.

A—Wood Floors.

B—Concrete Floors.

A—Wood Floors. If gutters are required, wooden boxes are to be constructed at least 2 inches wider and 2 inches deeper than the depth and width of the iron gutters, so that there may be a space for applying the Waterproofing (see sketch). Over the wood under floor lay one ply of GF No. 18 Waterproof Felt, lapping the edges 2 inches and nailing well with flats and nails. Then apply the number of layers of Waterproofing to be used extending this course down and around sides and bottoms of gutter boxes. After the iron gutters are installed, fill in under them with hot GF No. 17 so that the entire free space shall be filled solid.

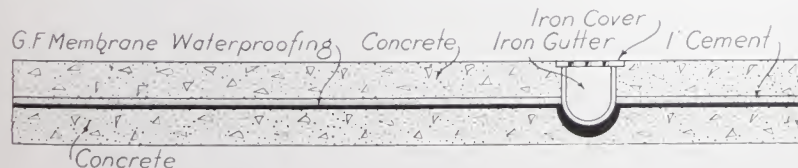


Laying Sleepers for Finished Floor:

The sleepers for the finished flooring are to be laid and nailed at the same time the surface coating of GF No. 17 is being applied, the carpenters working in conjunction with the waterproofer to the end that the sleepers may be embedded in the hot GF No. 17 Mop Coating and the nail holes rendered waterproof.

(Note: When nails are driven through the hot and plastic GF No. 17 this material will firmly bond to the nails and not leave them afterward, thus rendering the joining water-tight.)

B—Concrete Floors. Form depressions in concrete underbed for iron gutters which are to have copper flanges on either side at least 6 inches in width. These gutters are to be set so that they will come to the proper level in relation to the finish floor. After the underbed of concrete is properly smoothed and graded with Portland Cement Mortar lay the Waterproofing over the entire floor, including the depressions for the gutters.



Specifications—Continued

Setting Gutters:

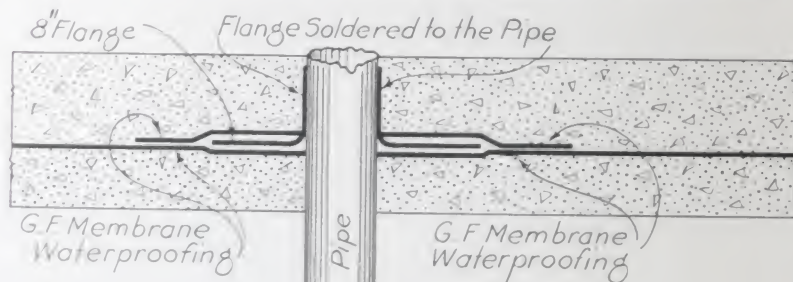
Set the gutters so that the flanges will rest upon the Waterproofing and fill under the gutters solid with GF No. 17 Mop Coating. Then bring the copper flanges of the gutter down upon the Waterproofing, nailing these flanges at least every 6 inches (see sketch). Then lay three plies of Waterproofing the full width of the flanges, lapping 8 inches out on floor Waterproofing.

Protecting Waterproofing:

Then protect the entire surface of the Waterproofing with 1 inch of Portland Cement Mortar and after this has thoroughly set lay the finished concrete floor.

Connecting Waterproofing to Pipes, Columns, Etc.:

All pipes, columns, etc., passing through the Waterproofing are to have copper flanges extending 8 inches out on floors and 6 inches up on pipes or columns. After Waterproofing is installed these flanges are to be placed sticking under surfaces of the flanges to the Waterproofing with hot GF No. 17 and then soldering the tops to columns or pipes. Then apply over these flanges three plies of Waterproofing solidly stuck to the flanges, coated and extended 8 inches out on floor Waterproofing.



Flanges for Hot Water and Steam Pipes:

In the case of hot water or steam pipes the flanges must be of iron and the pipes threaded so that the flanges can be screwed onto the pipes, using red lead to render the screw joints water-tight. After the flanges have been screwed in place these lower edges of the flanges should be waterproofed with three plies of Waterproofing solidly stuck to the flare of the flange and the Waterproofing carried out over the floor at least 8 inches.

Condition No. 9.

Box Girder Bridge.

After all rivet heads have been plastered up to an even surface with Portland Cement Mortar, which is to be pitched properly to all drains, the entire surface, including sides and bottoms of boxes, is to be waterproofed with 5 plies of GF No. 18 Waterproofing Felt and six plies of GF No. 17 Mop Coating, pushing this Waterproofing down into all corners and depressions. The general condition clause calling for the filling of all right angle joints with Portland Cement Mortar to form a round turn must be very carefully followed in this connection.

Protecting Concrete:

When this Waterproofing has thoroughly set cover with concrete to a height of at least 8 inches above the top flanges of the boxes. This concrete to be laid very wet so that no ramming will be required as this might break the Waterproofing course.

Specifications—Continued**Condition No. 10.****Seepage and Natural Soil Drainage, Dampproofing Against.**

All surfaces to be coated are to be clean, dry and free from all loose particles of mortar, etc.

Wherever water is present it must be carried away by drainage or pumping so as to maintain the work in an absolutely dry condition.

GF No. 17 must be applied with an ordinary cotton yarn mop at such a degree of temperature that it will not lump when it comes in contact with cold masonry. The material must be kept at a temperature ranging from 250 to 300 degrees in the "kettle" in order to be of proper consistency.

After the surfaces have been thoroughly cleaned and are absolutely dry, apply two thorough covering coats of GF No. 17 over the footing course, through the key, in the following manner:

First: Coat the entire footing and imbed in this coating (while hot) a layer of GF No. 18 Waterproof Felt, allowing same to lap at least 6 inches either side of the wall lines.

Second: Coat this Felt with a thorough coating of GF No. 17, taking care that the Felt is not displaced in the operation.

Third: After the foundation wall is set in place, the lap on the outside of the footing is to be turned up and stuck to this wall with a coating of GF No. 17, after which two thorough covering coats are to be mopped over the outside of the wall up to grade.

Great care must be taken that a perfect connection is made to the lap through the footing.

After the rough concrete floor has been prepared, mop two thorough covering coats of GF No. 17 over this surface, connecting with the laps through the footings.

After this has been done, the finish floor is to be laid over this coating. (The finish floor in no case to be less than 3 inches in thickness.)

GF No. 16 Foundation Brush Coating.

The protection of below-grade structural work from dampness is a self-evident necessity. Every building erected has its problem of this kind, and various problems require radically different treatment. They can be divided, however, into several general classifications.

When dampness and seepage from surface drainage only is the problem GF No. 16 Foundation Brush Coating is the proper waterproofing agent. It has been compounded for this particular purpose and the material used selected with particular reference to the needs of such work.

GF No. 16 is a heavy black liquid with a bituminous base, which is applied with a brush to the surfaces to be waterproofed, either with or without the use of felt or burlap reinforcing, depending on conditions to be met.

GF No. 16 Foundation Brush Coating has all the plastic and pliant qualities of GF No. 200, being made from the same base but with a much heavier body, consistent with the work it must perform. It is applied cold and bonds thoroughly to the masonry and will yield readily to any expansion or contraction.

If the object of the waterproofing is merely to protect the substructure from dampness and the walls are fairly smooth GF No. 16 will be found an amply sufficient protection in itself. If, however, there is a hydrostatic head of water to be combated, this pressure must be given due consideration, at the same time making proper arrangements for relieving the foundations of water while the waterproofing is being perfected. In such cases the GF No. 16 should either be rein-

forced with felt or it may be advisable to use GF No. 15 Trowel Coating with rough walls or GF No. 17 Mop Coating (applied hot) or even the integral method—all described in this book.

To thoroughly protect sub-structures against surface drainage and the absorption of moisture through capillary attraction a dampproof course must be provided over the footings and on top of the underbed of the concrete floor, as well as on the outside of walls in contact with surrounding soil. For this work the use of GF No. 16 is the most economical method. It does not require heating and is very easily applied.

The covering capacity of GF No. 16 will vary from 40 to 75 square feet of surface per gallon. So much depends on the nature of the surface to be covered that a general estimate cannot be made closer than this.

Specifications for GF No. 16 Foundation Brush Coating.

General Conditions:

GF No. 16 Foundation Brush Coating, as manufactured by The General Fireproofing Company, Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized Agents and is to be delivered on the building site in its original sealed packages. It is to be applied without addition or adulteration.

All surfaces to be coated are to be clean, dry and wire brushed to be sure that they are free from all loose particles of mortar, etc.

Whatever water is present must be carried away by drainage or pumping so as to maintain the work in an absolutely dry condition.

Condition No. 1.

Seepage and Natural Soil Drainage, Dampproofing Against: After the surfaces have been thoroughly cleaned and are absolutely dry, apply two thorough covering coats of GF No. 16 over the footing course and through the key in the following manner:

First: Coat the entire footing and imbed in this coating a layer of GF Waterproof Felt, allowing same to lap at least 6 inches either side of the wall line.

Second: Coat this Felt with a thorough coating of GF No. 16, taking care that the Felt is not displaced in the operation.

Third: After the foundation wall is set the lap on the outside of the footing is to be turned up and stuck to this wall with a coating of GF No. 16, after which two thorough covering coats are to be brushed over the outside of the wall up to grade.

Great care must be taken that a perfect connection is made to the lap through the footing.

After the rough concrete floor has been prepared, two thorough covering coats of GF No. 16 are to be brushed over this surface, connecting with the laps through the footing and the finished floor laid over this coating. (The finish floor in no case to be less than 2 inches in thickness.)

Condition No. 2.

Dampproofing Interior Face of Walls Before Erecting metal furring and lathing or tile or hollow brick furring.

Two thorough covering coats of GF No. 16 are to be applied over the entire face of all exposed walls, carrying the coating into all recesses and reveals and out on all connecting partitions and ceilings at least 18 inches from the side wall.

Then erect the metal lath or tile furring as usual.

Condition No. 3.

Dampproofing Inside of Swimming Pools, Cisterns, etc.

After the surfaces have been prepared in accordance with general conditions two thorough coats of GF No. 16 are to be applied to the side walls and floors of (name whether cisterns, tanks, etc.) and then this material is to be protected with a lining of either plaster, brick, tile or some other covering to protect it against abrasion.

GF No. 15 Trowel Coating.

Where considerable water pressure must be coped with on sub-structural work and where walls to be waterproofed offer very uneven surfaces, a liquid compound cannot be used effectively. To meet that condition GF No. 15 Foundation Trowel Coating has been prepared. It is of the same high grade bituminous base as the GF No. 16 and No. 200, but is of a putty-like consistency and is applied with a trowel. Because of its superior weight and body it is adapted to use under the most severe conditions, where GF No. 16 would not have sufficient body to fill up the holes or resist the pressure. It may be used either above or below grade and is especially serviceable where a wall has many cracks or depressions which could not be easily filled up with a liquid.

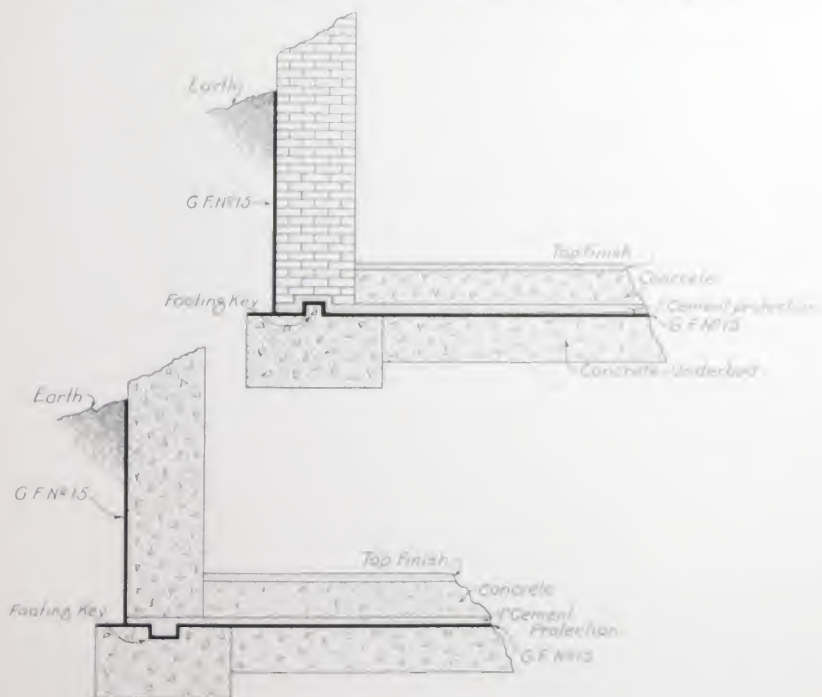
GF No. 15 is very easily applied and can be put on by anyone familiar with the use of a trowel. It does not stick to the trowel but works as smooth as Gypsum plaster. An ordinary workman can easily cover from 600 to 800 square feet per day, depending on the thickness of the coat to be used.

The covering capacity of GF No. 15 depends entirely on the thickness of the coating.

A coating $1/16$ inch thick covers 26 square feet to the gallon.

A coating $1/24$ inch thick covers 38 square feet to the gallon.

A coating $1/32$ inch thick covers 51 square feet to the gallon.



Specifications for GF No. 15 Trowel Coating.

General Conditions:

GF No. 15 Trowel Coating as manufactured by the General Fireproofing Company, Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized Agents, and is to be delivered on the building site in original and sealed packages. It is to be applied without adulteration or addition.

After (mention surfaces) are thoroughly cleaned and dry, the coating may be applied.

Whatever water is present must be carried away by drainage or pumping so as to maintain the work in an absolutely dry condition.

Condition No. 1.

Seepage and Natural Soil Drainage—Waterproofing Against.

After the surfaces have been prepared in accordance with the general conditions, apply with a trowel over the footing course a coating of GF No. 15 not less than $\frac{1}{8}$ inch thick. Cover this with one layer of GF No. 18 Waterproof Felt, allowing the latter to project on both sides of the wall at least six inches beyond the line of the foundation wall to be erected on the footing. Then this protecting layer of GF No. 18 Felt is to be coated with a coating $\frac{1}{8}$ inch thick.

After the foundation wall is set, the lap on the outside of the footing is to be turned up and stuck to this wall with a coating of GF No. 15, after which a coating $\frac{1}{8}$ inch thick is to be trowelled over the entire outside of the wall up to the grade line, taking great care that a perfect connection is made with the lap through the footings turned up on the outside of the wall.

After the rough concrete floor has been prepared, a trowel coating $\frac{1}{8}$ inch thick and connecting with the lap through the wall over the footing must be applied over the entire floor before the finish floor is laid. (See design, page 37.)

(Note: The finish floor in no case to be less than three inches in thickness.)

Condition No. 2.

Hydrostatic Head of Water in Conjunction with Drainage System.

Before actual waterproofing can be commenced, it is necessary to build a permanent sump pit into which all the water shall be drained by means of trenches filled with broken stone or porous tile drain pipe covered with a sheet of Waterproof Felt, over which the Waterproofing is to be carried. Provision must be made for the ejection of water collected in the sump pit, by means of a pump or otherwise, to keep the substructures free from all pressure.

After the footing course has been thoroughly dried out, trowel a coating of GF No. 15 over the entire footing not less than $\frac{1}{8}$ inch thick. Cover this with one layer of GF No. 18 Waterproof Felt, allowing the latter to project on both sides of the footing at least six inches beyond the wall line and then coat this projecting layer with a $\frac{1}{8}$ -inch thick coating of GF No. 15.

After the wall has been set and the laps on the outer side of the wall have been sealed to the wall apply a coating of GF No. 15 $\frac{1}{8}$ inch thick over this entire wall to one inch above grade level, taking great care that a perfect connection is made with the lap at the footing.

This coating shall also be carried over the underbed of concrete after same has been prepared to take it, making a connection as heretofore specified with the footing course.

Condition No. 3.

Sealing Intersection of Wall and Ceiling in Fireproof Construction Before Dampproofing.

Apply a $\frac{1}{8}$ -inch thick coating of GF No. 15 with a trowel on the under side of floor slab and down inside face of exposed walls for a distance of not less than six inches from the ceiling angle. From this point apply GF No. 200 Damp-proofing Coating.

Specifications—Continued

Condition No. 4.

Dampproofing Interior Face of Walls Before Erecting Metal Furring and Lathing, or Tile or Hollow Brick Furring.

Trowel a thorough coat of GF No. 15 over the entire wall, carrying it into all recesses and reveals and out on all connecting partitions and ceilings six inches from side wall. Then erect the Metal Lath or Tile Furring as usual.

Condition No. 5.

Waterproofing Parapet Walls and Under Copings.

Apply to the inside face of all parapet walls a trowel coating of GF No. 15 not less than $\frac{1}{16}$ inch thick, carrying this coating over top of wall before the cement bed for the coping is laid. This coating should be carried under all cap and base flashings and used as a flexible filler for the joint of the cap flashing.

Condition No. 6.

Underbedding Wood or Concrete Under Floors of Mills, Garages, Stables, etc.

Where GF No. 15 Trowelling Coating is to be applied over wood under floor, first nail down rosin sized sheathing paper to present a continuous surface to receive the Waterproofing. Trowel over the entire floor surface a coating of GF No. 15 Trowel Coating not less than $\frac{1}{16}$ inch thick, taking care to make same level as well as continuous. This coating to be carried down the sides of gutters and depressions and up side walls, columns, etc., to a height not less than one inch above finished floor level.

Condition No. 7.

Flat Tile in Roof or Floor Construction to be Waterproofed Under.

The surface, whether of concrete or wood, to which the GF No. 15 is to be applied must be properly graded to all outlets without any depressions.

Trowel GF No. 15 Foundation Trowel Coating over the surface to a thickness of $\frac{1}{2}$ inch, bringing it to a smooth and even surface. Upon this coating lay a bed of cement mortar one inch in thickness waterproofed with GF No. 10 Integral Waterproofing Paste into which the tile are to be bedded, care being taken to bring the tile up to a true and even surface. Joints between the tiles are to be $\frac{1}{4}$ inch in width and filled with Portland Cement Grout waterproofed with GF No. 10 Integral Waterproofing Paste.

Where expansion joints are required, they should be left not less than one inch in width and grouted with GF No. 250 Mastic Cement of the same color as the tile being used.

GF No. 220 Stainproof Stone Backing.

Wherever limestone, marble and other light colored and costly stones are used there is an absolute need of the protection of these stones from the unsightly stains to which they are susceptible. These stains are caused by the absorption of the coloring matter or salts from the backing walls. The dampness carrying these stains will invariably find its way to the surface of the stone, resulting in unsightly disfigurations of otherwise beautiful finishes.

That architects realize the danger from this source is evidenced by the fact that they almost invariably specify a non-staining cement for the setting of such stones. These are good as far as they go, but it has been demonstrated time and again that to protect stone from stains from the cement mortar used in laying the backing some means must be used not only to repel dampness but acids and alkalies as well. In fact, a sealing of the pores in the stone itself is the only one sure way of solving the problem.

GF No. 220 has been compounded with all these requirements taken into consideration. It is not only waterproof but it is alkali and stainproof as well. Even though non-staining cement or lime putty be used a coating of GF No. 220 should be applied as an extra precaution against stain from the cement itself or against the possibility of uneven application.

GF No. 220 does not contain any penetrating oils which will in themselves cause stains—in fact this coating does not penetrate into the stone at all. It simply lays over the surface and thoroughly seals the surface pores. This is a trouble found in some stone-backing compounds but has been entirely eliminated in GF No. 220.

Specifications for GF No. 220 Stainproof Stone Backing.

General Clause:

GF No. 220 Stainproof Stone Backing as manufactured by the General Fireproofing Company, Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized Agents, and is to be delivered on the building site in original and sealed packages. This material must be applied without addition or adulteration.

The surfaces of the stone to be coated are to be cleaned and dried thoroughly before receiving the coating.

Condition:

Limestone, marble, sandstone, etc., to be protected against stains, etc.

All unexposed faces of the stone to be thoroughly covered to within one inch of the edge of the face with two coats of GF No. 220 Stainproof Stone Backing, 24 hours to elapse between coats.

The coating thus applied must become completely dry before the stones are handled.

After the stones have been set in place, and before the backing has been carried up, the entire surface, including joints, should be given a thorough covering coat of GF No. 220, great care being taken to see that all joints are thoroughly coated.

Note: Where necessary to protect the face of limestone from gases, etc., in the atmosphere, we recommend the application of GF No. 145. See page 53.

GF No. 200 Dampproofing Coating.

THE protection of inner wall surfaces from dampness has always been a problem for every architect and builder. It not only involves the protection of wall decorations but is a necessity from a standpoint of modern sanitation. Damp walls—even though the dampness be not apparent to the eye—are breeders of sickness and disease. As either a remedy or a preventative GF No. 200 Dampproofing Coating has been developed by years of experiment.

GF No. 200 is a viscous black coating to be applied with a brush and is not to be applied to surfaces which are to be permanently exposed but rather as a furring coating between walls and their finished surfaces.

This coating, to begin with, is waterproof. It has the tough and elastic characteristics of its bituminous base which means that it is sufficiently pliable to adapt itself to whatever contraction or expansion may occur in the surfaces to which it is applied. GF No. 200, with its non-drying base, never dries out or becomes brittle nor is affected by heat or cold, but remains pliant. It sets with a strong "tack"—that is, it remains sticky, so to speak, for a period of about 30 days, so that it may be plastered upon any time after 24 hours and up to 30 days. These characteristics are inherent in the bitumen on which this coating is based and are consequently always uniformly reliable. As a result it is self-evident that a coating of GF No. 200 applied correctly to brick or stone walls, terra cotta blocks or the back of interior trim forms an absolutely permanent waterproof film. This coating, while mainly used on the inside wall, may be and is frequently used on the outside of masonry walls in combination with a coating of cement plaster.

GF No. 200 also serves well another purpose. Applied correctly it has much insulating value. It makes buildings warm in winter or cool in summer as it resists materially the passage of heat from either within or without.

The advisability of using this coating is not only present on solid walls, but even where terra cotta furring or hollow brick lining is used it will be found necessary many times to protect plaster from dampness. The method by which furring is supposed to protect plaster from dampness is by creating an air space, but this protection cannot be complete because the partitions in the blocks themselves afford continuous conductors for moisture from exterior to interior and through them a certain amount of dampness is bound to seep in. To overcome this, many architects are specifying the application of GF No. 200 in addition to the regular furring. The coating may be applied either to the wall before the blocks are in place or to the furring blocks themselves before the plastering is put on. Here, too, the insulating value of GF No. 200 is apparent. The air space created by the use of furring is only an insulator as long as the air is dry. It is an accepted fact that damp air is an excellent conductor of heat and cold and a coating of GF No. 200 placed on the bare wall before the furring is applied will insure the air in this space against all dampness.

Another reason for the use of GF No. 200 in connection with interior terra cotta walls and also terra cotta floor slabs, particularly if they

happen to have been erected in cold weather, is that a certain amount of moisture is always stored up in such construction. Under the influence of the sun's heat or even the heat in the building itself, this moisture will be released in a short time, and acting on the salts in the masonry will cause many disfiguring stains in plaster and decorations. The application of GF No. 200 Dampproofing Coating is a sure preventative of this trouble, and the protection of costly interior decorations more than repays for the initial cost of this treatment. Of course, to secure the full measure of results as regards this point the GF No. 200 should be applied to the face of furring blocks after they are erected, in addition to the regular coating on the masonry wall itself, as the furring will contain more or less moisture. If metal furring and lathing be used this is not the case. Where walls are thus dampproofed the coating should extend 18 inches out on the ceiling to prevent moisture from outside wall penetrating the floor slab and staining the ceiling. See specifications for GF No. 15 Trowel Coating for this purpose.

Where stucco is applied to terra cotta, brick or stone walls, a coating of GF No. 200 applied to the surface before the stucco is put on will not only protect the inner walls but also guard against efflorescence from the backing wall on the exterior. This efflorescence is merely the effect of stored moisture on the natural salts in the masonry, and the continuous pliant film formed by the GF No. 200 coating merely prevents its coming to the surface. In using this material for outside work, the first scratch coat of cement mortar should be applied over the dampproofing within five days.

One other use of this GF No. 200 coating is its application to the back of wood trim before the trim is erected on green masonry walls. This protects the trim from all dampness from plaster work and consequently from swelling, and is a precaution inexpensive to start with but important and far-reaching in its results. Not only is the trim itself thus protected, but the finish applied to the trim is also protected from discoloration due to salts in the plaster.

GF No. 200 will cover on the average about 75 square feet to the gallon for the first coat and about 100 square feet on the second coat, making an average of 45 square feet of finished surface to the gallon for two coats. This will vary according to the roughness of the surface to be covered and these estimates are very conservative. On a smooth, dense wall the covering capacity may be increased from 20 to 25 per cent.

Specifications for GF No. 200 Dampproofing Coating.

General Clauses:

GF No. 200 Dampproofing Coating as manufactured by the General Fireproofing Company, Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized Agents, and is to be delivered on the job in original sealed packages. It must be used without the addition of any thinning agents or any adulteration.

Great care must be taken in the application of this coating to see that no pin-holes remain and that a thorough covering coat is obtained.

Pointing:

All large holes must be pointed up to provide a surface to receive the Dampproofing.

Specifications—Continued

Condition No. 1.

Inner Face of Brick, Stone or Terra Cotta Walls to be Dampproofed Before Plastering With or Without Air Space.

The interior faces of all weather exposed walls (mention whether brick, stone, terra cotta) are to be thoroughly coated with two coats of GF No. 200 Dampproofing Coating, allowing 24 hours to elapse between coats, and 24 hours to elapse after the second coat is applied before any plaster is applied over the coating. The coating to be carried into all chases and reveals and well brushed into all recesses and joints—in a word, the entire coating must be continuous.

The intersecting angles of all brick or terra cotta walls and terre cotta or concrete floor slabs coming in contact with weather exposed walls should be carefully coated, the coating being carried out from the wall not less than 18 inches on all such intersecting walls or floor slabs.

Plaster may be applied over surfaces covered with GF No. 200 Dampproofing Coating within an interval of from 1 to 30 days after the application of the coating.

(Note: While a thorough job of Dampproofing can be successfully done with one coat of GF No. 200, the specifications call for two coats because the success of the work depends on the surface being absolutely covered, and this is difficult of accomplishment with one coat because of the fact that the brick masons do not lay a wall absolutely devoid of holes, and the man applying the coating cannot be depended upon to absolutely fill up these holes and crevices with the Dampproofing. Where two coats are called for it is practically certain that the second coat will cover any voids that may have been left in the first coat.)

Condition No. 2.

Dampproofing Exterior of Hollow Tile Wall Before Applying Cement Plaster.

After the joints between the porous terra cotta blocks have been thoroughly pointed, apply two coats of GF No. 200 Dampproofing Coating over the entire surface of the terra cotta blocks, brushing this Dampproofing thoroughly into all grooves and over all joints. The coating must be allowed to cure for 24 hours after the second coat is applied before any cement plaster is put onto the surface.

(Note: While GF No. 200 Dampproofing Coating is adaptable to porous terra cotta blocks, it should never be used on vitrified blocks. The most effective treatment in the latter case would be to incorporate GF No. 10 Integral Waterproofing throughout the stucco with which the blocks are covered, or GF No. 10 Paste should be incorporated in the mortar with which the blocks are laid, or a waterproof surface coating may be used outside the stucco. For this purpose we would recommend the application of either our Colorless Waterproofing GF No. 100 or our Brick and Cement Coating in colors of the series GF No. 101.)

Condition No. 3.

Terra Cotta Ceilings and Partition Walls to be Stainproofed and Dampproofed.

Before applying GF No. 200 Dampproofing Coating rake out all joints to a depth of $\frac{1}{4}$ or $\frac{3}{8}$ inch. If surface of tile is smooth, (vitrified) roughen this surface by hacking with a chipping hammer, then apply GF No. 200, covering the surface thoroughly. After the second coat of Dampproofing has set for 24 hours the scratch coat of plaster may be applied.

Condition No. 4.

Trim in Contact with Plastered Surfaces or Masonry to be Dampproofed on the Back.

The back of all trim shall receive a heavy coat of GF No. 200 Dampproofing before it is erected. This coating may be applied either at the plant where the trim is manufactured or on the job immediately before it is erected.

GF No. 100 Colorless Waterproofing.

(For Exteriors)

GF No. 100 is a colorless liquid for the waterproofing of exterior walls where it is desired to retain the original color and texture of the surface. It is a brush coating—penetrating and pore-filling—and a waterproofing compound of undisputed merit. It provides one of the simplest means of making leaky side walls water-tight, whether of concrete or other masonry.

When applied, GF No. 100 is absolutely colorless, thus preserving the most delicate shades of stucco, stone or face brick in their original state. It does not contain wax, as do many coatings on the market for similar use, and consequently does not leave the greasy film that these other products form. It leaves no surface coating which will hold dirt or dust.

One of the most adaptable places for the use of GF No. 100 is in stucco exteriors. In addition to preventing moisture from penetrating to the metal lath on which the stucco is plastered, or to the interior of tile walls where that type is used, it also makes the surface so effectively water-shedding that it will be free from the streaked and soaked appearance so common after hard rains. It must be remembered that stucco in that condition becomes more or less of a dirt catcher and the cause of many of the grime-streaked stucco walls is the collection of dirt and soot when the walls are wet and holding moisture. This same condition is present with the use of cement blocks and in either case GF No. 100 means better appearance always and longer life.

Another advantage of GF No. 100 for stucco walls is that it will prevent frost from penetrating and thus obviates the danger of unsightly cracks from this source. This in itself will pay for the cost of the application in one season.

With proper care GF No. 100 is also of great assistance in preventing efflorescence. While it is very difficult to remedy this trouble once it has started, yet if proper care is taken in treating the wall it may be done. In the case of old buildings where this trouble already exists, if full details are forwarded the manufacturers of GF Waterproofing materials will be glad to prescribe the proper treatment in detail.

The waterproofing of parapet walls is a very important item. As a rule they are more fully exposed to the elements than any other part of the building, bearing the full brunt of a storm from whichever direction it may be coming. As the roof flashing can only be carried about half way through the wall it is necessary that the surface on the back be waterproofed or the water will strike through and be carried down into the building. It is also necessary to waterproof the face of the parapet down to a point 6 inches below the line where interior furring or damp-proofing stops.

GF No. 100 is especially adaptable here because of the simplicity of its application and because it does not discolor the walls or in any way destroy their appearance as compared with the rest of the building. GF No. 100 will not leave a water line where this coating stops.

GF No. 100 is also used effectively as a waterproof coating for the interior of water tanks, swimming pools, etc. This only applies to work where there is no outside water pressure with which to contend and where the only object is to prevent leaks from the container itself.

It should be understood that this method of waterproofing is only effective where a dense concrete has been used. Where a very porous wall is encountered a method for waterproofing will be prescribed if full details are sent to the manufacturers of GF materials.

If it is an underground tank or where for any reason there is water pressure from the outside, integral waterproofing should be employed as shown in this book under that caption.

This method of waterproofing should only be used on virgin surfaces, and must never be applied to a surface which has previously received a paint coating.

The covering capacity of GF No. 100 must of necessity vary directly in proportion to the porosity of the surface to which it is to be applied, but on the average it is about 100 square feet to the gallon, two coats. Where surfaces to be waterproofed need not retain their original color, a cement wash should be applied prior to the application of the waterproof coating. This serves to diminish the number of pores, fill up cracks and holes too small to be cared for by the "pointing up" process, and the quantity of GF No. 100 required will be diminished.

Covering Capacity

First coat.....	100 to 150 sq. ft. per gallon
Second coat.....	200 to 250 sq. ft. per gallon
Two coats.....	80 to 100 sq. ft. per gallon

Specifications for GF No. 100 Colorless Waterproofing.

General Clause:

GF No. 100 Colorless Waterproofing as manufactured by the General Fireproofing Company, Youngstown, Ohio, is to be purchased direct from the manufacturers or their authorized Agents and is to be delivered on the building site in original and sealed packages. It must be applied as received without addition or adulteration of any kind.

Application:

GF No. 100 is to be applied in not less than two coats and all surfaces to which it is applied are to be clean and dry before coating.

Preparation of Surface:

Before the GF No. 100 is applied, all surfaces should be carefully pointed and wire brushed so as to remove all loose particles and foreign matter.

Where it is not important that the original color of the surface should be retained the wall should be drenched with clear water and, while still wet, a thin cream made from Portland Cement and water is to be thoroughly brushed over this surface for the purpose of filling up the small cracks and holes not reached by the pointing. After this cement wash has thoroughly hardened and is dry, brush off such of it as refuses to adhere and proceed with the application of the Colorless Waterproofing.

(Note: The fact that the GF No. 100 is designed as a small pore filler and transparent coating explains why this application of a cement wash is advisable, if the surface is very open and porous, for the material itself has not enough body to really fill a hole or a crack as large as would admit a knife blade.)

Specifications—Continued

Method of Coating:

In no case should less than two coats of GF No. 100 be applied, and where the surface is very porous apply as many additional coats as may be required to completely saturate the surface. Use a short handled stiff bristle brush and apply the material with a force sufficient to drive it well into the surface. The more vigorous the use of the brush the better will be the results obtained from the coating.

Condition No. 1.

Leaky Rough Brick or Concrete Walls to be Waterproofed.

After the general conditions have been fulfilled, two thorough saturating coats of GF No. 100 Colorless Waterproofing (or as many more as may be necessary to thoroughly fill the surface) are to be applied to (mention the surfaces). Twenty-four hours is to be allowed to elapse between coats.

Condition No. 2.

Exterior Face of Concrete or Other Masonry Surface to be Dampproofed.

After the general conditions have been fulfilled and sufficient time has been allowed for the pointing to become thoroughly hardened, apply not less than two coats of GF No. 100, brushing it vigorously so as to insure penetration beneath the surface. At least 12 hours are to elapse between coatings.

(Note: The best results from the application of GF No. 100 are to be obtained when the temperature is above 70 degrees F. It must **not** be applied when the temperature of wall is below 60 degrees F.)

Condition No. 3.

Checking Efflorescence on Walls.

Brush off, without the use of water, all powdery excrecence, salts, etc., from the face of the wall. When convinced that the wall and the pointing put in joints and crevices is thoroughly dry, apply a sufficient number of coats of GF No. 100 Colorless Waterproofing to completely close the pores of all weather exposed surfaces.

As another insurance against this trouble appearing again it is absolutely necessary to calk all around doors and windows with GF Roof and Tile Mastic Cement in accordance with specifications under that heading on pages 50 and 51.

(Note: Particular care must be taken in this treatment that the backs of parapet walls are carefully treated to be sure that they are absolutely watertight.)

Condition No. 4.

Interior Surfaces of Concrete or Brick Containers to be Waterproofed.

The surface to be prepared in accordance with general conditions.

After the pointing is thoroughly dry, apply to the interior of reservoirs, tanks, etc., to fill up cracks, etc., two coats of cement wash of cement and water, made in the consistency of a thin cream to the surfaces to be coated. After this has cured brush off all material that does not adhere strongly to the wall, and apply not less than two coats of GF No. 100 Colorless Waterproofing, allowing the usual time of 12 hours to intervene between coatings.

This material should be allowed to set as long as possible before it is subjected to pressure of liquids on the inside of the tank, as it takes several days for it to reach its maximum strength.

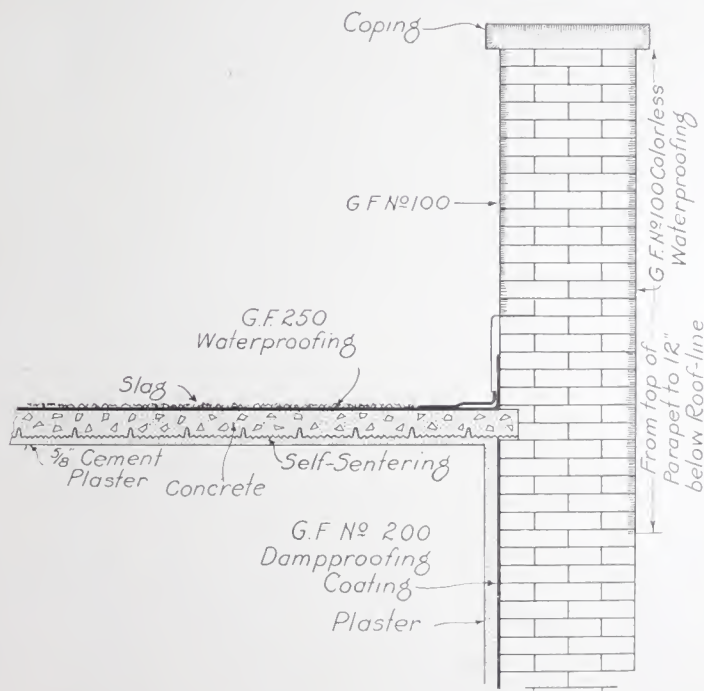
(Caution: This treatment must never be used to resist any water pressure from the outside of the tank or from the opposite surface to which it is applied.)

Specifications—Continued

Condition No. 5.

Parapet Walls and Copings to be Waterproofed.

After the general conditions have been fulfilled, apply to both sides of parapet walls not less than two coats of GF No. 100 Colorless Waterproofing, carrying this coating from the cap flashing up the back of the parapet over the coping stone and down the exterior side of the parapet wall to at least 6 inches below where the Damp-proofing or Furring on the interior face of the wall ceases.



Method of Waterproofing Parapet Walls. Showing also the use of GF No. 200 for Dampproofing and GF No. 250 for Roof Waterproofing

GF No. 101 Brick and Cement Coating.

The widespread use of stucco and cement exterior finishes for buildings of every character has brought about a demand for a coating which can be successfully used over a surface of this kind, not only to waterproof the wall but to preserve its texture, equalize the uneven appearance due to variation in material and uneven application and in many cases to add a touch of color or tint for artistic effect.

The use of ordinary paints with linseed oil can never be satisfactory over masonry surfaces. The ordinary oils used in regular paint will combine immediately with the alkalies in the cement, forming a soap which would be soluble in water, and continued rainstorms will eventually destroy the effectiveness of the coating.

There have been efforts to overcome these troubles by the use of various chemicals intended to change alkali into an inert material but the varying density of any wall meant that a different solution was necessary for different parts of the surface. Where the solution was not exactly sufficient to neutralize the alkaline action it weakened the bond of the cement, and chipping and scaling of the paint film and the cement was the result. Other experiments have been made with solutions of various acid salts, such as zinc, alum, etc., but they also weaken the bonding power of the cement and at the same time introduce much moisture into the surface which must be allowed to thoroughly evaporate before any coating could be applied.

With all these things in mind, GF No. 101 Brick and Cement Coating has been scientifically compounded, using pigments and vehicle which are not affected in any way by the constituents of cement—in fact which have a decided affinity for concrete. It is a coating which is both waterproof and decorative—which can be applied to brick, tile and stone as well as cement—which penetrates the pores to an extent that it becomes an integral part of the surface without in any way destroying its texture. It overcomes any lack of uniformity in surface shading and gives either a soft, flat finish or a glossy surface of any desired shade.

The coating will adhere tenaciously, will set hard enough to resist action of the elements and yet remains elastic enough to conform to expansion or contraction stresses in the wall itself.

GF No. 101 is furnished in different shades (see color card) and can be furnished in either flat or gloss finishes.

Covering Capacity

First coat.	100 to 150 sq. ft. per gallon
Second coat.	200 to 250 sq. ft. per gallon
Two coats	80 to 100 sq. ft. per gallon

Specifications for GF No. 101 Brick and Cement Coating.

Condition:

Exterior Concrete, Brick or Other Masonry Surfaces to be Dampproofed with Coating Which Imparts a Fine Color Finish.

General Clause:

GF No. 101 Brick and Cement Coating as manufactured by the General Fireproofing Company, Youngstown, Ohio, must be purchased from the manufacturers direct or from their authorized Agents. The material must be delivered on the site in original sealed packages and applied according to the manufacturer's directions.

The GF No. 101 must be thoroughly stirred before using and during the application often enough to keep the pigments in suspension. Neglect of this precaution will result in an uneven coating which will greatly injure the appearance of the finished work.

Preparation of Surface:

The surface to receive this coating must be clean, dry and any particles of foreign matter must be removed by wire brushing or scraping before the coating is applied.

Preparation of Previously Painted Surfaces:

Where it is desired to coat a surface that has been previously painted, this surface must be thoroughly wire brushed so as to remove all loose particles of material adhering to the surface. Then two coats of GF No. 101 may be applied in the manner specified below.

Weather Conditions:

Owing to the nature of the material, weather conditions must be considered in treating a surface with GF No. 101. A temperature of from 60 to 80 degrees is most favorable to its application and the material must **not** be applied when the temperature is below 60 degrees. To get the best results the material should not be applied when there is an excess of humidity in the atmosphere.

Application:

It is advisable to add a small proportion of turpentine in the first coat as an aid to penetration. No thinner may be used for the second coat or any succeeding coats.

Two coats of GF No. 101 are necessary to an even colored job. The second coat is to be applied 24 to 48 hours after the application of the first coat and there is to be an interval of 24 to 48 hours between succeeding coats.

GF No. 250 Mastic Cement.

GF No. 250 is widely used for pointing between copings and walls, between flashing and walls, for joints between vault lights, embedding hip rolls and ridgings, pointing up valleys where close fits are not possible, around leaky chimneys; in fact any place where joints or cracks in masonry call for an effective protection against water penetration. In combination with oakum it is used for filling cracks around doors, window frames, skylights or dormer windows.

GF No. 250 Mastic Cement is a compound of extreme toughness, strength and adhesive powers and in itself forms an adequate and permanent waterproofing. It has a putty-like consistency but sets like cement mortar. It never becomes entirely hard, however, and is not affected by changes of temperature.

As a waterproofing coating for concrete roofs there has been a demand for a plastic material which would not become brittle and would be sufficiently elastic to protect possible hair cracks or even expansion cracks in the concrete—one that would do away with the necessity of built-up composition roofing. GF No. 250 can be successfully used for this purpose.

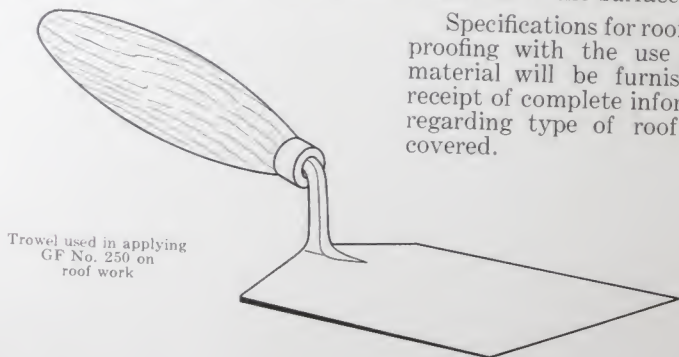
GF No. 250 is applied with a trowel or with a 3-inch scraper. If a trowel is used, the material is smoothed down with the end of a flat plasterers' trowel. On a reasonably smooth surface a gallon will cover approximately as follows:

1/16 inch thick.....	26 square feet
1/24 inch thick.....	38 square feet
1/32 inch thick.....	51 square feet

It can be applied to shingles, tin, canvas, ready roofing, slate, tile or concrete and adheres readily to all. It is furnished in Black, Brown, Red, Gray, Green and Buff.

Because this material never sets hard it may catch enough dirt and dust to form a film over the surface and where, for appearance sake, this is undesirable, slag, pebbles, crushed brick, marble, or granite or colored sand may be rolled into the finished surface to prevent this and at the same time give an artistic treatment to the surface.

Specifications for roof waterproofing with the use of this material will be furnished on receipt of complete information regarding type of roof to be covered.



Trowel used in applying
GF No. 250 on
roof work

Specifications for GF No. 250 Mastic Cement.

Conditions:

Waterproofing:

- A—Backs of Parapet Walls.
- B—Cap Flashings.
- C—Joints between Window Frames and Walls.

Materials:

GF No. 250 Mastic Cement as manufactured by The General Fireproofing Company, Youngstown, Ohio, must be purchased direct from the manufacturers or their authorized Agents. This material must be delivered on the building site in original and sealed packages. It must be applied according to the manufacturer's directions, without addition or adulteration.

Condition A.

Waterproofing the Backs of Parapet Walls.

Application:

A thorough coating of GF Mastic Cement is to be trowelled over the back of parapet walls, great care being taken to see that the joint between cap flashing and the first course of brick above is very carefully filled up. Where there is a concrete parapet, this Mastic Cement should be brought down well under the copper flashing so as to thoroughly seal this joint.

This coating should be carried up to and under the coping whether it be of tile, limestone or concrete.

Condition B.

Setting Cap Flashings.

Before the cap flashing is set onto the brickwork, a coating of GF No. 250 Mastic Cement should be trowelled over the entire surface of the brickwork. After the cap flashing is set, another thorough covering coat should be trowelled over the top of the flashing so as to give a thoroughly filled joint before the cement mortar is applied for setting the upper course of brick.

Condition C.

Pointing Up Around Window Frames.

Remove the hanging stile from outside frame of window casing and calk plumbers' oakum into the opening until the space is filled to within $\frac{1}{4}$ inch of the surface. After the joint has been partially filled with oakum in this manner, GF No. 250 should be trowelled in so as to fill the joint flush with the surface. Care is to be taken to see that this material is forced into the opening so as to thoroughly fill it and leave no cracks at either side. Considerable pressure should be used so as to insure a bond of the material to the wood on the one side and the cement, tile or brick on the other.

GF No. 140 Concrete Hardener.

(The Integral Method of Hardening Concrete Floors)

Ordinary concrete, regardless of every precaution with which it is laid, will almost invariably have a marked tendency to dust with the slightest wear. In the case of floors and sidewalks this becomes a serious problem, not only because of the steady deterioration of the floor itself, but because of the damaging effects of the dust so caused. It is a known fact that dust from cement floors can work great havoc with machinery and will penetrate to the most closely guarded bearings. In addition to this it has recently been found that this cement dust is very harmful to all kinds of textile goods and in warehouses where such material is stored considerable damage may be done if precautions to guard against this are not taken.

To make concrete floors of sufficient density to resist all abrasion and consequently prevent this dusting is a problem which may be solved to a greater or less extent in several ways. The most permanent, however, and at the same time the most economical where it is practical, is to introduce a hardening element into the concrete itself.

GF No. 140 is a finely graded mineral powder, combined with an oxidizing agent. When mixed with the wet concrete it bonds thoroughly with the lime, silica and other elements, resulting in a dense, hard, wearproof and dustproof floor. The introduction of this element into the concrete does not in any way change the manner of laying the concrete floors but simply means the adding of this extra ingredient and adding the drying coat as indicated in the specifications.

GF. No. 140 is put up in 100-pound paper lined cloth sacks. From 15 to 30 pounds is required to every 100 square feet of floor surface, depending upon the severity of the traffic.

Specifications for GF No. 140 Concrete Hardener.

For Dustproofing Concrete Floors.

Materials:

The proportion of the finish is to be one part any approved Portland Cement, $1\frac{1}{2}$ parts clean, sharp sand, free from dust or loam, and one part crushed traprock, granite or white grit that will pass a $\frac{3}{16}$ -inch screen. GF No. 140 Concrete Hardener is manufactured by the General Fireproofing Company, Youngstown, Ohio, in the proportion as specified below.

Concrete Hardener must be purchased direct from the General Fireproofing Company or their authorized Agents, and must be used absolutely in accordance with the manufacturer's directions. The material must be brought on the building site in original and sealed packages.

Top Finish:

Mix the cement, sand and grit thoroughly together in the manner usually employed when laying an ordinary concrete floor, turning it at least three times dry. Then add sufficient water (not exceeding 18 gallons per barrel of cement) to temper the mass to the desired consistency. If more water is used it will take a longer time before it is ready for finishing after the GF No. 140 Concrete Hardener as a drying coat is applied.

Specifications—Continued

Drying Coat:

For every 100 square feet of surface take 15 pounds of GF No. 140 and 15 pounds of Portland Cement and mix same thoroughly together dry.

(Note: Where floors are to be subjected to excessively hard wear, write the General Fireproofing Company the conditions to which the floors are to be subjected and they will send you a special specification for the particular type of floor. The proportion above given is for floors which are to be subjected to ordinary wearing conditions.)

Method of Laying:

Spread the top finish to the desired thickness ($\frac{3}{4}$ or 1 inch) ruling it off with a straightedge to a smooth and even surface. Work this top finish very thoroughly with a float to remove all bubbles, etc. As soon as the water rises to the surface (the water will probably rise to the surface in 15 to 30 minutes) spread the mixture of cement and GF No. 140 Concrete Hardener, already prepared, as a drying coat over the entire space using a fine screen (or sieve) and taking great care to leave no bare spots.

When the floor is ready for finishing, which will be in about three or four hours, work the surface thoroughly with a wooden float. Tamp the surface down well with a wooden float and rub the Floor Hardener and cement mixture into the floor thoroughly. Then finish in the usual manner with a steel trowel.

Twenty-four hours after the floor is finished it should be wet down and kept wet for a period of six days either by flushing with water two or three times a day, or the surface of the floor may be covered by a layer of sawdust, paper or sand kept wet. The floor should then only be used for light traffic for a period of thirty days or until the skin coat of cement, brought to the surface by the action of troweling, is worn away. After this skin coat of cement has been worn off, the hard, dustless surface formed by the Concrete Hardener will be exposed to traffic.

GF No. 145 Crystalrox.

For more than forty years the French have been the most successful in the preservation of limestone. Investigation has shown that they are using Magnesia Fluats. Crystalrox are an adaptation of Magnesia Fluats which in combination with lime in limestone, marble or cement, have a chemical reaction. The result of this chemical action is a surface that will not be attacked by dilute acids and furnishes powerful resistance to abrasion and water.

Crystalrox in solution will effectually preserve Bedford or any other limestone against disintegration. This result is obtained because the crystals react chemically on the constituents of the stone and harden it to such an extent as to form a protection against the attack of gases in the atmosphere. The gases that attack limestone are particularly present in large manufacturing centers where a great deal of soft coal is used.

Owing to the fact that the surface of the stone is rendered finer grained and non-porous, dust particles do not readily attach themselves to it, and a cleaner surface is insured.

The use of a solution of Crystalrox on a fairly good cement floor will increase its resistance to abrasion about one-third. It will also prevent the concrete from being attacked by dilute acids either organic or mineral. This treatment will protect a cement floor against dusting from ordinary traffic.

Approximately two pounds of Crystalrox dissolved in a gallon of water are required to make one gallon of liquid solution. Owing to the fact that the consistency is the same as that of water, the spreading

Specifications—Continued

power of the solution will be about 175 to 200 sq. ft. per gallon, two coats. Because of this large covering capacity the use of Crystalrox is cheaper than practically any other compound for the treatment of cement floors.

Specifications for Applying GF No. 145 Crystalrox.

General Conditions:

GF No. 145 Crystalrox are to be purchased direct from the manufacturers, The General Fireproofing Company, Youngstown, Ohio, or their authorized Agents. These materials are to be brought to the building site in original and sealed packages and applied in accordance with the manufacturer's specifications and directions.

All surfaces to be treated are to be clean and free from dust or any other foreign matter.

Application:

Dissolve two pounds of GF No. 145 in one gallon of water. After these crystals have thoroughly dissolved, the resulting solution is to be applied to (mention whether exterior or interior limestone or marble or whether as a hardener to the cement floors) as a thorough saturating coat. This solution is to be applied with a brush or sponge, so as to insure the entire saturation of the surface being coated.

If all the solution does not penetrate into the concrete or stone after five or ten minutes, remove the surplus with a sponge.

After the surface has entirely dried out, apply a second coat, in the same manner.

If the surface being treated is extremely porous, apply a third coat in the same manner.

Caution:

Great care should be exercised to see that surfaces are dry after each application and that all the material has been absorbed. Any material left on the surface and not absorbed will crystalize and, because it does not come in contact with the lime, would in no way be affected and therefore would be of no use as a protection.

Solution of GF Crystalrox should be kept in earthenware and no metal of any kind is to come in contact with the material.

Workmen who are applying this material must be very careful not to let it come in contact with their eyes or cuts or bruises on their hands, as its action is very corrosive.

GF No. 150 Floor Primer.

Regardless of the care used in the mixing, there will often occur at irregular intervals sections of the surface more absorbent than the surrounding floor. Then when a cement coating is applied to this surface it will of necessity penetrate further and uniformity of the coating color will be broken.

GF No. 150 Colorless Floor Primer has for its object the correcting of the irregular porosity which is bound to occur in the best of cement work and which will show through even the best of cement floor coatings. This lack of uniform color in subsequent coatings is accounted for by the variable density present in every concrete floor.

A priming coat such as GF No. 150 will remedy this trouble because it will fill the surface pores, harden the surface and give a uniformly even base for the finish coat.

Incidentally, even outside of its value in securing uniform color effects, the use of GF No. 150 is an economical proposition. Where GF No. 151 Floor Coating is to be used, the use of the less costly primer will save one coat of the more expensive material. In cases where three coats of GF No. 151 would be required it will be found that the GF No. 150 can be substituted for the first coat and the resulting floor will be every bit as satisfactory.

GF No. 150 may also be used as a complete floor coating in itself. It is particularly used where no color effect is required.

Covering Capacity

Single coat. ————— 150 sq. ft. per gallon

Specifications for GF No. 150 Floor Primer.

The Floor Primer is to be GF No. 150 as manufactured by the General Fireproofing Company, Youngstown, Ohio, and is to be purchased direct from them or their authorized Agents. The material is to be brought on the building in original and sealed packages and applied without addition or adulteration.

Preparation of Surfaces:

The (name floors to be coated) are to be cleaned of all grease, mortar, plaster and other spots, thoroughly broomed and washed clean with clear water. Allow the floor to dry thoroughly before the coat of Primer is applied.

The Floor Primer shall be carefully brushed into all surfaces, using a stiff bristle brush. In no case shall a gallon be allowed to cover more than 150 square feet of surface.

GF No. 151 Floor Coating.

GF No. 151 is a cement floor coating which has been particularly prepared for floors of office buildings, schools, theaters, halls and similar public buildings—in fact any floor called on to withstand ordinary traffic. It is of a nature closely akin to cement itself in that in use it will practically combine with the cement surface and become a part of it. It is impervious to oil, water or grease and is easily cleaned. It gives a firm, smooth and dustless surface that will defy all ordinary wear, will be non-abrasive and non-dusting, and has a most attractive and very durable finish.

Can be furnished in different colors. Regularly it is furnished in a high gloss but it can also be supplied with a flat finish where desired. Ask for our color card showing various shades in which this can be furnished.

Covering Capacity

First coat	200 sq. ft. per gallon
Second coat	300 sq. ft. per gallon
Two coats	125 sq. ft. per gallon

Specifications for GF No. 151 Floor Coating.

Floor Coating of the color specified shall be GF No. 151 as manufactured by the General Fireproofing Company, of Youngstown, Ohio, and shall be purchased direct from them or their authorized Agents. The material shall be brought on the building in original and sealed packages and applied without addition or adulteration.

Application:

After the Floor Primer has been allowed to set for 48 hours the contractor shall apply two or more coats to the floor as specified, care being taken that the coating is evenly brushed out leaving a uniform and continuous color surface.

All doors leading to spaces coated shall be locked so that no one may intrude upon them for at least 48 hours after the coating is applied.

GF No. 400 Bonding Compound.

(For Bonding New Concrete to Old)

The problem of bonding new concrete to old is one that occurs not only in repairing or adding to old concrete but in all new concrete in securing a bond between one day's work and the next. In waterproofing by the use of waterproofed cement mortar, also, adhesion is indispensable to good work and a great part of the success of such work is dependent on this factor.

GF No. 400 has been developed to overcome this difficulty by preparing the surface to secure a bond—sure and dependable—which will make the concrete as continuous as though applied at one time.

Former methods for accomplishing this included scouring, hacking, wire brushing and similar expedients, but they were crude and not always satisfactory, as these methods did not always expose the aggregate. The real obstacles to a perfect joint between new and old concrete are a thin, glassy cement film, which forms on the surface of concrete when it sets, together with dirt and foreign substances adhering thereto. The only measure which will secure a perfect bond is a process whereby every particle of foreign substance is removed from the old surface and the concrete film destroyed, so that the sand aggregate is again exposed to the activity of the new concrete.

GF No. 400 is a powerful acid powder. Dissolved in water, it forms a solution which, applied to a concrete surface, however dense, immediately effervesces, removes the film and exposes the aggregates of the concrete ready for the joining with the new material.

GF No. 400 has been prepared with a full knowledge and careful observance of the peculiarities of concrete and with every precaution taken that it will in no way injure the strength or durability of the work to which it is applied. Indeed, tests show that concrete bonded together in this way and tested to destruction will break quicker at any other point than at the place of joining.

Two pounds of GF No. 400 will treat from 100 to 150 square feet. It is put up in two-pound packages, and packed 12 and 24 packages to the case.

Specifications for Treatment With GF No. 400 Bonding Compound.

The Bonding Compound used for all work shall be that manufactured by the General Fireproofing Company, Youngstown, Ohio, and shall be purchased direct from them or their authorized Agents and brought to the building site in original and sealed packages. This material shall be applied according to the manufacturer's directions.

Preparation of Surface:

Roughen the surface well with a mason's chipping hammer, then clean with a wire brush so as to remove all loose particles. Into each gallon of water to be used in washing the surface, dissolve not less than 2 pounds of GF No. 400 Bonding Compound.

Specifications—Continued

Application:

Apply a liberal coat of GF No. 400 in solution to the roughened surface, using either a corn broom or an acid brush. Permit this to remain until all effervescence and chemical action has stopped.

If the first application does not completely clean the surface and expose all aggregates, apply a second coating of the same mixture in the same manner.

Directly after the GF No. 400 has exhausted itself (after all chemical action has stopped) wash down the surface by several applications of clear, clean water and if the surface is thoroughly saturated by this means to a point where it will absorb no more water, apply a thin cream of cement and water. (If a hose is available for washing down the wall, this affords the best means of cleaning it readily and also of saturating it thoroughly.) Before this cream of cement and water sets and becomes hard, join on the new concrete as this will form a bond film to the old concrete.

Covering Capacity:

One gallon of GF No. 400 in solution will cover from 100 to 150 square feet, the range being proportionate to the porosity of the surface to which it is to be applied.

GF No. 500 Interior Wall Coating.

In the preparation of GF No. 500 Interior Wall Coating, two essentials for a material of this kind have governed its manufacture entirely—first, sanitation; second, decorative effect. The first consideration, sanitation, was influenced by the widespread agitation against wall-paper and similar coverings—particularly for public buildings. Consequently even the ingredients used in this wall finish have been selected with particular reference to their purity and their immunity from any element which might propagate or foster germ life. In this respect, as a result, GF No. 500 typifies everything that is clean and wholesome. It is readily cleaned with a damp cloth or can be washed with soap and water without in any way destroying its appearance.

From the decorative standpoint, GF No. 500 has been brought up to a high standard of excellency by many experiments to determine the best proportions and methods of compounding to secure the soft, rich tones so desirable in a wall finish. As a result the color effects obtainable by its use are unsurpassed—it is equally effective on wood, cement, stucco or metal, and imparts a rarely beautiful finish adaptable to the most simple or the most luxurious furnishings. It flows readily under the brush, leaves a dense, clean color, has a great covering capacity, and in fact is a most desirable interior finish for any class of work.

Covering Capacity

First coat.....	350 sq. ft. per gallon
Second coat.....	400 sq. ft. per gallon
Two coats about.....	187 sq. ft. per gallon

GF Protective Coatings for Iron and Steel.

In the making of GF Protective Coatings for Iron and Steel there have been taken into consideration those points which are necessary to coatings of this kind, namely—adhesiveness, rust prevention, and elasticity enough so that it will not break under the expansion or contraction of the steel.

GF No. 300 is a shop coating for structural steel made with careful observance of these requirements. The pigments forming the base were selected because of their rust-inhibiting properties and are carefully compounded to secure a minimum of voids. Their anti-rust properties not only prevent the rusting of new surfaces but will check rust that has already started.

The oil in which these pigments are ground is a combination of known adherent character and the whole when applied resolves itself into a film of extremely high resistance to the elements which are injurious to metal.

GF No. 300 is made in four different colors—Gray, Green, Red or Brown and while it is originally intended for a primer coat its use is not so limited and it can be used as a decorative coat for iron or steel work. It forms a heavy, lustrous, weatherproof coating.

Covering Capacity

First coat.....	approximately 200 sq. ft. per gallon
Second coat.....	approximately 200 sq. ft. per gallon
Two coats.....	approximately 100 sq. ft. per gallon

Specifications for Coating of Steel Using GF No. 300 Shop Coating.

Material:

Material designated as shop coating for steel is to be GF No. 300 Shop Coating for Steel as manufactured by the General Fireproofing Company, Youngstown, Ohio, and is to be purchased direct from them or their authorized Agents. The material is to be brought on the work in the original and sealed packages and applied without addition or adulteration.

Cleaning the Steel:

All steel before coating shall be carefully wiped to remove all moisture and oil and then wire brushed to remove all loose scale.

Application:

Apply a coating of GF No. 300, working the compound into all the joints and crevices before riveting the parts together. Another coat is to be applied after the steel sides are riveted and before removal from the shop. The removal from the shop is to take place not less than 48 hours after the final coating of GF No. 300 is applied.

Field Coating:

After erection all abraded surfaces are to be retouched with GF No. 300 having first removed either by wiping or otherwise all foreign matter that may have attached itself to the steel during transportation and the time it was laying on the job. After this second coating has been done on the job, the steel, after erection, shall receive one heavy coat of GF No. 325.

GF No. 325 Field Coat.

(For Structural Steel)

The advent of this material marks another revolution in the manufacture of metal protective coatings. Its particular field is the finish coat on iron and steel which is to be incased in concrete or other masonry. It is waterproof and alkali-proof.

The pigment used as a base for this material instead of being ground with the vehicle or carrier, is fused into it under great heat so that there can never be a separation of pigment and vehicle. This means that a coating of GF No. 325 forms an impenetrable film, tough and elastic, expanding or contracting like a rubber film with the action of the steel.

GF No. 325 is likewise an effective insulator, acting as an invincible barrier against stray electric currents and preventing absolutely the evil effects of electrolysis so often present in structural work.

When linseed oil paints are used to protect steel enclosed in masonry, the oil is attacked immediately by the lime in the cement and decomposition occurs rapidly. This permits the moisture ever present in green masonry to reach the steel and corrosion is set up at once. The ingredients used in making GF No. 325 are immune from the action of the lime in the cement or cement grout and consequently the protecting film remains intact.

Covering Capacity

First coat	approximately 200 sq. ft. per gallon
Second coat	approximately 200 sq. ft. per gallon
Two coats	approximately 100 sq. ft. per gallon

Specifications for GF No. 325 Field Coating for Steel.

Material:

GF No. 325, manufactured by the General Fireproofing Company, Youngstown, Ohio, must be purchased from the manufacturers direct or from their authorized Agents and must be delivered on the building site in original and sealed packages and applied without adulteration or addition according to the following instructions:

Immediately after erection the steel is to be closely examined to ascertain whether the shop coating has suffered any damage in transportation or erection. If such is the case re-coat such portions as have been damaged with GF No. 300. After allowing this supplementary coating to become thoroughly dry apply the finishing coat of GF No. 325 Field Coating for Steel, brushing same evenly and thoroughly so that the surface may be smooth and continuous.

Before the different parts are placed they should be carefully inspected to see that they are all thoroughly covered with coating.

THE
Vo
Reprint
Relative
proport
tions by
volume
Cement
Sand
1 0
1 1
1 1
1 1
1 2
1 2
1 3
1 3
1 4
NOT
may affect
*Cem
One
thick
thick
10"

CUBIC

Width 4
Inch
4" 41
5" 51
6" 61
7" 72
8" 82
9" 92
10" 102
11" 113
12" 123
13" 133
14" 144
15" 154
16" 164
17" 174
18" 185
19" 195
20" 205
21" 216
22" 226
23" 236
24" 246
25" 256
26" 266
27" 277
28" 288
29" 299
30" 309
31" 319
32" 329
33" 339
34" 349
35" 359
36" 369

Table No. 13

Volume of Plastic Mortar Made from Different Proportions of Cement and Sand
Quantities of Materials Per Cubic Yard

Reprinted by permission from Taylor & Thompson's "Concrete, Plain and Reinforced," page 230

Relative proportions by volume*	Volume of Compacted Plastic Mortar										Materials for 1 cu. yd. Compact Plastic Mortar Based on barrel of					
	From 1 cu.ft. Cemt.					From 1 bbl. Cement					3 5 cu. ft.		3.8 cu. ft.†		4 cu. ft.	
	Based on Port. Cemt. weighing					Based on barrel of										
	Cement	Sand	108 Lbs. per Cu. Ft.	100 Lbs. per Cu. Ft.†	95 Lbs. per Cu. Ft.	3.5 Cu. Ft.	3.8 Cu. Ft.†	4 Cu. Ft.			Packed Cement	Loose Sand	Packed Cement	Loose Sand	Packed Cement	Loose Sand
1	0		0.93	0.86	0.80	3.2	3.2	3.2	3.31	3.31	bbl.	cu. yd.	bbl.	cu. yd.	bbl.	cu. yd.
1	1 ₁₆		1.12	1.06	1.02	3.9	4.0	4.1	3.92	0.46	0.73		0.47	0.61	0.49	
1	1		1.48	1.42	1.38	5.2	5.4	5.5	5.22	0.68	1.01	0.71	0.88	0.72		
1	1 ₈		1.84	1.78	1.74	6.4	6.7	7.0	6.20	0.81	1.40	0.84	1.37	0.86		
1	2		2.20	2.14	2.11	7.7	8.1	8.4	7.31	0.91	1.32	0.93	1.61	0.95		
1	2 ₅		2.56	2.50	2.47	9.0	9.5	9.9	8.01	0.98	1.24	1.00	1.74	1.01		
1	3		2.92	2.86	2.83	10.2	10.9	11.3	9.64	1.03	1.16	1.05	1.89	1.06		
1	3 ₁₆		3.28	3.23	3.19	11.5	12.2	12.8	10.35	1.06	1.20	1.08	2.12	1.10		
1	4		3.64	3.59	3.55	12.8	13.6	14.2	11.22	1.10	1.28	1.11	2.39	1.13		

NOTE—Variations in the fineness of the sand and the cement, and in consistency of the mortar may affect the values by 10% in either direction.

*Cement as packed by manufacturer, sand loose.

†Use these columns ordinarily.

One cubic yard cement plaster covers:

$\frac{5}{8}$ " thick—63 sq. yds. $\frac{7}{8}$ " thick—45 sq. yds. $1\frac{1}{4}$ " thick—31 $\frac{1}{2}$ sq. yds. $1\frac{3}{4}$ " thick—22 $\frac{1}{2}$ sq. yds.

$\frac{3}{4}$ " thick—54 sq. yds. 1" thick—36 sq. yds. $1\frac{1}{8}$ " thick—27 sq. yds. 2" thick—18 sq. yds.

10% lime added will increase these quantities not more than 5%.

Table No. 14

Cubic Yards Concrete Required for Beams, Columns and Slabs

CUBIC YARDS OF CONCRETE FOR BEAMS 100 FT. LONG										COLUMNS		SLABS						
										SQUARE	ROUND							
Width	4 Inch	5 Inch	6 Inch	7 Inch	8 Inch	9 Inch	10 Inch	11 Inch	12 Inch	Side of Square or Diam. of Round	Cubic Yds. per Ft. Height Weight per Ft. Height and Area Section	Cubic Yds. per Ft. Height Weight per Ft. Height and Area Section	Thickness	Cubic Yds. Per 100 Sq. Ft.	Weight Per Sq. Ft.			
	4"	412								6"	.009	36						
	5"	515	643							7"	.013	49						
	6"	617	772	926						8"	.016	64		2 1/4"	6175	24		
	7"	720	900	1080	1260					9"	.021	81		3"	7715	30		
	8"	823	1029	1235	1440	1646				10"	.026	100		3 1/2"	926	36		
	9"	926	1157	1389	1620	1852	083			11"	.031	121						
	10"	1029	1286	1543	1802	2058	2315	2572		12"	.037	144	029	113	1			
	11"	1132	1415	1697	1981	2263	2546	2829	3112	13"	.043	169	034	132	7	4 1/2"	1235	48
	12"	1235	1543	1852	2162	2469	2778	3086	3395	14"	.050	196	040	153	9			
	13"	1337	1672	2006	2340	2673	3009	3343	3677	15"	.058	225	045	176	7			
	14"	1440	1801	2162	2521	2881	3241	3601	3961	16"	.066	255	052	201	1			
	15"	1543	1929	2315	2701	3086	3472	3858	4244	17"	.074	284	058	227	0			
	16"	1646	2058	2468	2881	3293	3704	4115	4526	18"	.083	324	065	254	5			
	17"	1749	2186	2624	3063	3498	3935	4373	4810	19"	.093	361	073	283	5	5 1/2"	1698	51
	18"	1852	2315	2778	3241	3704	4167	4630	5093	20"	.103	400	081	313	2			
	19"	1955	2443	2923	3403	3883	4363	4843	5323	21"	.113	441	089	346	4			
	20"	2058	2572	3063	3563	4063	4563	5063	5563	22"	.124	484	098	380	1			
	21"	2162	2701	3241	3781	4321	4861	5402	5941	23"	.136	529	107	415	5	6 1/2"	2006	78
	22"	2263	2829	3393	3957	4521	5085	5649	6213	24"	.148	576	116	452	4			
	23"	2366	2958	3549	4141	4732	5324	5916	6507	25"	.160	625	126	490	9	7"	2161	84
	24"	2469	3086	3704	4321	4938	5556	6173	6790	26"	.174	676	136	530	9			
	25"	2572	3215	3858	4501	5143	5786	6429	7072	27"	.187	729	147	572	6	7 1/2"	2315	90
	26"	2673	3343	4024	4705	5386	6067	6748	7429	28"	.201	784	158	615	8	8"	2469	96
	27"	2778	3472	4167	4861	5556	6249	6944	7638	29"	.216	841	170	660	5	8 1/2"	2624	102
	28"	2881	3601	4321	5041	5761	6481	7202	7922	30"	.231	900	182	706	9	9"	2778	108
	29"	2984	3729	4475	5221	5967	6713	7459	8205	31"	.246	961	194	754	8	9 1/2"	2932	114
	30"	3086	3858	4605	5351	6097	6843	7589	8335	32"	.263	1024	207	804	2	10"	3086	120
	31"	3189	3987	4745	5503	6261	7019	7777	8535	33"	.280	1089	220	855	3	10 1/2"	3241	126
	32"	3292	4115	4941	5767	6593	7419	8245	9071	34"	.292	1156	233	907	9	11"	3396	132
	33"	3395	4245	5081	5917	6753	7589	8425	9261	35"	.311	1225	247	962	1	11 1/2"	3550	138
	34"	3498	4375	5221	6067	6913	7759	8605	9451	36"	.333	1296	262	1017	9	12"	3704	144

Table No. 16

Quantities of Materials for One Cubic Yard of Rammed Concrete
Based on a Barrel of 3.8 Cubic Feet

(Reprinted by permission from Taylor & Thompson's "Concrete, Plain and Reinforced," page 231)

Proportions by Parts			Proportions by Volumes			Volume of Mortar in Terms of Percentage of Volume of Stone	Percentages of Voids in Broken Stone or Gravel															
							50%*			45%†			40%‡			30%§			20%			
Cement	Sand	Stone	Packed Cement	Loose Sand	Loose Stone	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.		
1	1	1	1	3.8	94	5.09	0.72	4.90	0.69	4.73	0.67	4.33	0.61	4.02	0.57	0.82	2.65	0.75	0.82	2.65	0.75	
1	1	2	1	7.6	51	3.67	1.03	3.48	0.98	3.30	0.93	2.93	0.82	2.65	0.75	0.82	2.65	0.75	0.82	2.65	0.75	
1	1	3	1	11.4	36	2.69	1.14	2.54	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	4	1	15.2	29	2.29	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	5	1	19.0	25	1.90	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	6	1	22.8	22	1.66	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	7	1	26.6	20	1.46	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	8	1	30.4	19	1.29	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	9	1	34.2	18	1.15	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	10	1	38.0	17	1.03	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	11	1	41.8	16	0.93	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	12	1	45.5	15	0.84	1.14	2.22	1.07	2.22	1.07	2.22	0.94	1.98	0.84	0.94	1.98	0.84	0.94	1.98	0.84	
1	1	1½	1	3.8	57	3.19	0.45	0.67	3.08	0.43	0.65	2.97	0.42	0.63	2.78	0.39	0.59	2.62	0.37	0.55	2.43	0.34
1	1	2	1	3.8	75	2.85	0.40	0.80	2.73	0.38	0.77	2.62	0.37	0.74	2.43	0.34	0.68	2.26	0.32	0.64	2.07	0.31
1	1	2½	1	3.8	61	2.57	0.36	0.90	2.45	0.34	0.86	2.34	0.33	0.82	2.15	0.30	0.76	1.99	0.28	0.70	1.80	0.27
1	1	3	1	3.8	51	2.34	0.33	0.90	2.22	0.31	0.94	2.12	0.30	0.90	1.93	0.27	0.82	1.77	0.25	0.75	1.60	0.26
1	1½	2	1	5.7	93	2.49	0.53	0.70	3.24	0.51	0.68	2.31	0.49	0.65	2.16	0.46	0.61	2.03	0.43	0.57	1.84	0.40
1	1½	2½	1	5.7	76	2.27	0.48	0.80	2.18	0.46	0.77	2.09	0.44	0.74	1.94	0.41	0.68	1.80	0.38	0.63	1.61	0.37
1	1½	3	1	5.7	64	2.09	0.44	0.88	2.00	0.42	0.84	1.91	0.40	0.81	1.76	0.37	0.74	1.63	0.34	0.69	1.44	0.33
1	1½	3½	1	5.7	55	1.94	0.41	0.90	1.84	0.39	0.91	1.76	0.37	0.87	1.61	0.34	0.79	1.48	0.31	0.73	1.29	0.30
1	1½	4	1	5.7	49	1.80	0.38	1.01	1.71	0.36	0.96	1.63	0.34	0.92	1.48	0.31	0.83	1.36	0.29	0.77	1.19	0.28
1	1½	4½	1	5.7	44	1.69	0.36	1.07	1.60	0.34	1.01	1.51	0.32	0.96	1.37	0.29	0.87	1.25	0.26	0.79	1.09	0.27
1	1½	5	1	5.7	40	1.59	0.34	1.12	1.50	0.32	1.06	1.42	0.30	1.00	1.28	0.27	0.90	1.17	0.25	0.82	1.00	0.26
1	1½	5½	1	5.7	37	1.49	0.33	1.20	1.41	0.31	1.10	1.33	0.29	0.97	1.19	0.26	0.93	1.10	0.24	0.84	0.93	0.25
1	2	3	1	7.6	65	1.76	0.49	0.87	1.68	0.47	0.83	1.61	0.45	0.79	1.48	0.42	0.73	1.38	0.39	0.68	1.29	0.36
1	2	4	1	7.6	57	1.65	0.46	0.93	1.57	0.44	0.88	1.50	0.42	0.84	1.38	0.39	0.78	1.27	0.36	0.72	1.19	0.33
1	2	4½	1	7.6	51	1.55	0.44	0.98	1.48	0.42	0.94	1.41	0.40	0.89	1.28	0.36	0.81	1.18	0.33	0.75	1.10	0.31
1	2	5	1	7.6	47	1.47	0.41	1.03	1.39	0.39	0.98	1.32	0.37	0.93	1.20	0.34	0.84	1.10	0.31	0.77	1.03	0.30
1	2	5½	1	7.6	43	1.39	0.39	1.08	1.31	0.37	1.01	1.25	0.35	0.97	1.13	0.32	0.87	1.03	0.29	0.80	0.95	0.28
1	2	6	1	7.6	40	1.32	0.37	1.11	1.25	0.35	1.06	1.18	0.33	1.00	1.06	0.30	0.89	0.97	0.27	0.82	0.88	0.27
1	2½	3	1	9.5	87	1.72	0.61	0.73	1.66	0.58	0.70	1.60	0.56	0.68	1.49	0.52	0.63	1.40	0.49	0.59	1.31	0.46
1	2½	3½	1	9.5	75	1.62	0.57	0.80	1.55	0.55	0.76	1.49	0.52	0.73	1.38	0.49	0.68	1.29	0.45	0.64	1.22	0.43
1	2½	4	1	9.5	66	1.52	0.54	0.86	1.46	0.51	0.82	1.40	0.49	0.79	1.29	0.45	0.73	1.19	0.42	0.67	1.13	0.41
1	2½	4½	1	9.5	60	1.44	0.51	0.91	1.37	0.48	0.87	1.31	0.46	0.83	1.20	0.42	0.76	1.11	0.39	0.70	1.05	0.39
1	2½	5	1	9.5	54	1.37	0.48	0.96	1.30	0.46	0.92	1.24	0.44	0.87	1.13	0.40	0.80	1.04	0.37	0.73	0.99	0.37
1	2½	5½	1	9.5	49	1.30	0.46	1.01	1.23	0.43	0.95	1.17	0.41	0.91	1.07	0.38	0.83	0.98	0.34	0.76	0.93	0.36
1	2½	6	1	9.5	46	1.24	0.44	1.05	1.17	0.41	0.99	1.11	0.39	0.94	1.01	0.36	0.85	0.92	0.32	0.78	0.89	0.35
1	2½	6½	1	9.5	42	1.18	0.42	1.08	1.12	0.39	1.02	1.06	0.37	0.97	0.96	0.34	0.80	0.88	0.31	0.80	0.84	0.34
1	2½	7	1	9.5	40	1.13	0.40	1.11	1.07	0.38	1.05	1.01	0.36	0.99	0.91	0.32	0.90	0.83	0.29	0.82	0.80	0.33
1	3	4	1	11.4	76	1.42	0.60	0.80	1.36	0.57	0.77	1.30	0.55	0.73	1.21	0.51	0.68	1.12	0.47	0.63	1.05	0.44
1	3	4½	1	11.4	68	1.34	0.57	0.85	1.28	0.54	0.81	1.23	0.52	0.78	1.13	0.48	0.72	1.05	0.44	0.66	0.97	0.42
1	3	5	1	11.4	61	1.28	0.54	0.90	1.22	0.52	0.86	1.17	0.49	0.82	1.07	0.45	0.75	0.99	0.42	0.70	0.90	0.41
1	3	5½	1	11.4	56	1.22	0.52	0.94	1.16	0.49	0.90	1.11	0.47	0.86	1.01	0.43	0.78	0.93	0.39	0.72	0.84	0.40
1	3	6	1	11.4	52	1.16	0.49	0.98	1.11	0.47	0.94	1.05	0.44	0.89	0.96	0.41	0.81	0.88	0.37	0.74	0.78	0.39
1	3	6½	1	11.4	48	1.12	0.47	1.02	1.06	0.45	0.97	1.01	0.43	0.92	0.92	0.39	0.84	0.84	0.35	0.77	0.73	0.38
1	3	7	1	11.4	45	1.07	0.45	1.05	1.01	0.43	0.99	0.96	0.40	0.95	0.87	0.37	0.80	0.80	0.34	0.73	0.69	0.37
1	3	7½	1	11.4	42	1.03	0.44	1.09	0.97	0.41	1.02	0.92	0.39	0.97	0.83	0.35	0.85	0.76	0.32	0.80	0.66	0.36
1	3	8	1	11.4	40	0.99	0.42	1.11	0.93	0.39	1.05	0.88	0.37	0.99	0.80	0.34	0.90	0.73	0.31	0.82	0.62	0.35
1	4	5	1	15.2	76	1.12	0.64	0.80	1.08	0.61	0.76	1.04	0.59	0.73	0.96	0.54	0.68	0.90	0.51	0.63	0.84	0.46
1	4	6	1	15.2	64	1.04	0.59	0.88	0.99	0.56	0.84	0.95	0.54	0.80	0.87	0.49	0.73	0.81	0.46	0.68	0.75	0.43
1	4	7	1	15.2	55	0.96	0.54	0.95	0.92	0.52	0.91	0.88	0.50	0.87	0.80	0.45	0.79	0.74	0.42	0.73	0.67	0.42
1	4	8	1	15.2	49	0.90	0.51	1.01	0.85	0.48	0.96	0.81	0.46	0.91	0.74	0.42	0.83	0.68	0.38	0.77	0.61	0.41
1	4	9	1	15.2	44	0.84	0.47	1.06	0.80	0.45	1.01	0.76	0.43	0.96	0.68	0.38	0.80	0.63	0.35	0.80	0.55	0.40
1	4	10	1	15.2	40	0.79	0.44	1.11	0.75	0.42	1.06	0.71	0.40	1.00	0.64	0.36	0.90	0.58	0.33	0.82	0.50	0.39
1	5	10	1	19.0	47	0.73	0.52	1.03	0.69	0.49	0.97	0.66	0.46	0.93	0.60	0.42	0.84	0.55	0.30	0.77	0.45	0.38
1	6	12	1	22.8	46	0.62	0.52	1.04	0.58	0.49	0.98	0.56	0.47	0.94	0.50	0.42	0.84	0.46	0.39	0.78	0.40	0.37

Note—Variations in the fineness of the sand and the compacting of the concrete may affect the quantities 10 per cent in either direction.

*Use 50 per cent columns for broken stone screened to uniform size. †Use 45 per cent columns for average conditions and for broken stone with dust screened out. ‡Use 40 per cent columns for gravel or mixed stone and gravel. §Use these columns for scientifically graded mixtures.

Table No. 17
Quantities of Materials for One Cubic Yard of Rammed Concrete
Based on a Barrel of 4 Cubic Feet

(Reprinted by permission from Taylor & Thompson's "Concrete, Plain and Reinforced," page 322)

Proportions by Parts			Proportions by Volumes			Volume of Mortar in Terms of Percentage of Volume of Stone	Percentages of Voids in Broken Stone or Gravel														
							50%*			45%†			40%‡			30%§			20%§		
Cement	Sand	Stone	Packed Cement	Loose Sand	Loose Stone		Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone	Cement	Sand	Stone
			bbl.	cu. ft.	cu. ft.		bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.	bbl.	cu. yd.	cu. yd.
1	1	1	1	1	1	89	4.99	0.74	4.80	0.71	4.62	0.69	4.23	0.63	3.91	0.58	3.19	0.46	2.56	0.37	0.76
1	1	2	1	1	1	49	3.57	1.06	3.37	1.00	3.20	0.95	2.84	0.84	2.56	0.76	2.13	0.51	1.90	0.43	0.84
1	1	3	1	1	1	35		2.60	1.16	2.45	1.09	2.13	1.71	1.01	1.51	0.89	1.06	0.76	0.51	0.37	0.89
1	1	4	1	1	1	28							1.71	1.01	1.51	0.89	1.06	0.76	0.51	0.37	0.93
1	1	5	1	1	1	24							1.43	1.06	1.26	0.93	1.07	0.95			0.95
1	1	6	1	1	1	22							1.32	1.08	1.07	0.95					0.95
1	1	7	1	1	1	20									0.94	0.98					0.98
1	1	8	1	1	1	18									0.83	0.98					0.98
1	1	9	1	1	1	17									0.75	1.00					1.01
1	1	10	1	1	1	16									0.68	1.01					1.01
1	1	11	1	1	1	15									0.62	1.01					1.01
1	1	12	1	1	1	15									0.57	1.01					1.01
1	1	1½	1	4	6	96	3.08	0.46	0.68	2.97	0.44	0.66	2.87	0.42	0.64	2.69	0.40	0.60	2.53	0.38	0.56
1	1	2	1	4	8	73	2.74	0.41	0.81	2.63	0.39	0.78	2.52	0.37	0.75	2.33	0.34	0.69	2.17	0.32	0.64
1	1	2½	1	4	10	59	2.47	0.37	0.91	2.35	0.35	0.87	2.25	0.33	0.83	2.06	0.31	0.76	1.90	0.28	0.71
1	1	3	1	4	12	50	2.25	0.33	1.00	2.13	0.32	0.95	2.03	0.30	0.90	1.85	0.27	0.82	1.70	0.25	0.76
1	1½	2	1	6	8	92	2.39	0.53	0.71	2.30	0.51	0.68	2.22	0.49	0.66	2.07	0.46	0.61	1.94	0.43	0.58
1	1½	2½	1	6	10	74	2.18	0.48	0.81	2.09	0.46	0.77	2.01	0.45	0.74	1.86	0.41	0.69	1.73	0.38	0.64
1	1½	3	1	6	12	62	2.01	0.45	0.89	1.91	0.42	0.85	1.83	0.41	0.81	1.68	0.37	0.75	1.56	0.35	0.69
1	1½	3½	1	6	14	54	1.86	0.41	0.96	1.77	0.39	0.92	1.68	0.37	0.87	1.54	0.34	0.80	1.42	0.32	0.74
1	1½	4	1	6	16	48	1.73	0.38	1.03	1.64	0.36	0.97	1.56	0.35	0.92	1.42	0.32	0.84	1.30	0.29	0.77
1	1½	4½	1	6	18	43	1.62	0.36	1.08	1.53	0.34	1.02	1.45	0.32	0.97	1.31	0.29	0.87	1.20	0.27	0.80
1	1½	5	1	6	20	39	1.52	0.34	1.13	1.43	0.32	1.06	1.35	0.30	1.00	1.23	0.27	0.90	1.11	0.25	0.82
1	2	3	1	8	12	74	1.81	0.54	0.80	1.74	0.52	0.77	1.67	0.50	0.74	1.54	0.46	0.68	1.41	0.43	0.64
1	2	3½	1	8	14	64	1.69	0.50	0.88	1.61	0.48	0.83	1.54	0.46	0.80	1.42	0.42	0.74	1.31	0.39	0.68
1	2	4	1	8	16	56	1.58	0.47	0.94	1.51	0.45	0.89	1.44	0.43	0.85	1.32	0.39	0.78	1.21	0.36	0.72
1	2	4½	1	8	18	51	1.49	0.44	0.99	1.41	0.42	0.94	1.34	0.40	0.89	1.23	0.36	0.82	1.13	0.34	0.75
1	2	5	1	8	20	46	1.40	0.42	1.04	1.33	0.39	0.98	1.26	0.37	0.93	1.15	0.34	0.85	1.05	0.31	0.78
1	2	5½	1	8	22	42	1.33	0.39	1.08	1.26	0.37	1.03	1.19	0.35	0.97	1.08	0.32	0.88	0.98	0.29	0.80
1	2	6	1	8	24	39	1.26	0.37	1.12	1.19	0.35	1.06	1.13	0.34	1.00	1.02	0.30	0.91	0.93	0.28	0.83
1	2½	3	1	10	12	86	1.65	0.61	0.73	1.59	0.59	0.71	1.53	0.57	0.68	1.42	0.52	0.63	1.33	0.49	0.59
1	2½	3½	1	10	14	75	1.55	0.57	0.80	1.48	0.55	0.72	1.42	0.52	0.74	1.32	0.49	0.68	1.23	0.46	0.64
1	2½	4	1	10	16	66	1.46	0.54	0.87	1.39	0.51	0.82	1.33	0.49	0.79	1.23	0.46	0.73	1.14	0.42	0.68
1	2½	4½	1	10	18	59	1.38	0.51	0.92	1.31	0.48	0.87	1.25	0.46	0.83	1.15	0.43	0.77	1.06	0.39	0.71
1	2½	5	1	10	20	54	1.31	0.48	0.97	1.24	0.46	0.92	1.18	0.44	0.87	1.08	0.40	0.80	0.99	0.37	0.73
1	2½	5½	1	10	22	49	1.24	0.46	1.01	1.18	0.44	0.96	1.12	0.41	0.91	1.02	0.38	0.83	0.93	0.34	0.76
1	2½	6	1	10	24	45	1.18	0.44	1.05	1.12	0.41	1.00	1.06	0.39	0.94	0.96	0.36	0.85	0.88	0.33	0.78
1	2½	6½	1	10	26	42	1.13	0.42	1.09	1.07	0.40	1.03	1.01	0.37	0.97	0.92	0.34	0.89	0.84	0.31	0.81
1	2½	7	1	10	28	39	1.08	0.40	1.12	1.02	0.38	1.06	0.96	0.36	1.00	0.87	0.32	0.90	0.79	0.29	0.82
1	3	4	1	12	16	75	1.35	0.60	0.80	1.30	0.58	0.77	1.25	0.56	0.74	1.15	0.51	0.68	1.08	0.48	0.64
1	3	4½	1	12	18	67	1.28	0.57	0.85	1.23	0.55	0.82	1.18	0.52	0.79	1.08	0.48	0.72	1.01	0.45	0.67
1	3	5	1	12	20	60	1.22	0.54	0.90	1.16	0.52	0.86	1.11	0.49	0.82	1.02	0.45	0.76	0.94	0.42	0.70
1	3	5½	1	12	22	55	1.16	0.52	0.95	1.11	0.49	0.90	1.06	0.47	0.86	0.97	0.42	0.79	0.89	0.40	0.72
1	3	6	1	12	24	50	1.11	0.49	0.99	1.06	0.47	0.94	1.01	0.45	0.90	0.92	0.41	0.82	0.84	0.37	0.75
1	3	6½	1	12	26	48	1.06	0.47	1.02	1.01	0.45	0.97	0.96	0.43	0.92	0.87	0.39	0.84	0.80	0.36	0.77
1	3	7	1	12	28	44	1.02	0.45	1.06	0.97	0.43	1.01	0.92	0.41	0.95	0.83	0.37	0.86	0.76	0.34	0.79
1	3	7½	1	12	30	42	0.98	0.44	1.09	0.93	0.41	1.03	0.88	0.39	0.98	0.79	0.35	0.88	0.73	0.32	0.81
1	3	8	1	12	32	39	0.94	0.42	1.11	0.89	0.40	1.05	0.84	0.37	1.00	0.76	0.34	0.90	0.69	0.31	0.82
1	4	5	1	16	20	75	1.08	0.64	0.80	1.03	0.61	0.76	0.99	0.59	0.73	0.92	0.55	0.68	0.86	0.51	0.64
1	4	6	1	16	24	63	0.99	0.59	0.88	0.95	0.56	0.84	0.91	0.54	0.81	0.83	0.49	0.74	0.77	0.46	0.68
1	4	7	1	16	28	55	0.92	0.54	0.95	0.88	0.52	0.91	0.83	0.49	0.86	0.76	0.45	0.79	0.70	0.42	0.73
1	4	8	1	16	32	48	0.86	0.51	1.02	0.81	0.48	0.96	0.77	0.46	0.91	0.70	0.42	0.83	0.64	0.38	0.76
1	4	9	1	16	36	43	0.80	0.47	1.07	0.76	0.45	1.01	0.72	0.43	0.96	0.65	0.39	0.87	0.60	0.36	0.80
1	4	10	1	16	40	40	0.75	0.44	1.11	0.71	0.42	1.05	0.67	0.40	0.99	0.61	0.36	0.90	0.55	0.33	0.81
1	5	10	1	20	40	47	0.70	0.52	1.04	0.66	0.49	0.98	0.63	0.47	0.93	0.57	0.42	0.84	0.52	0.38	0.77
1	6	12	1	24	48	46	0.59	0.52	1.05	0.56	0.50	1.00	0.53	0.47	0.94	0.48	0.43	0.85	0.44	0.39	0.78

Note—Variations in the fineness of the sand and the compacting of the concrete may affect the quantities by 10 per cent in either direction.

*Use 50 per cent columns for broken stone screened to uniform size. †Use 45 per cent columns for average conditions and for broken stone with dust screened out. ‡Use 40 per cent columns for gravel or mixed stone and gravel. §Use these columns for scientifically graded mixtures.

Index

	Pages
Bonding Compound—GF No. 400 - - - - -	57-58
Brick and Cement Coating—GF No. 101 - - - - -	48-49
Colorless Waterproofing—GF No. 100 - - - - -	44-47
Concrete Hardener—GF No. 140 - - - - -	52-53
Crystalrox—GF No. 145 - - - - -	53-54
Dampproofing Coating—GF No. 200 - - - - -	41-43
Field Coating for Steel (black only)—GF No. 325 - - - - -	60
Floor Coating (in colors)—GF No. 151 - - - - -	56
Floor Primer—GF No. 150 - - - - -	55
Foundation Brush Coating—GF No. 16 - - - - -	35-36
Integral Waterproofing Paste—GF No. 10 - - - - -	9-22
Integral Waterproofing Powder—GF No. 11 - - - - -	23
Interior Wall Coating—GF No. 500 - - - - -	58
Mastic Cement—GF No. 250 - - - - -	50-51
Membrane Waterproofing - - - - -	26-35
Mop Coating—GF No. 17 - - - - -	26-35
Pressure Tables - - - - -	24-25
Shop Coating for Steel—GF No. 300 - - - - -	59
Specification Guide - - - - -	4-8
Stainproof Stone Backing—GF No. 220 - - - - -	40
Trowel Coating—GF No. 15 - - - - -	37-39
Waterproof Felt—GF No. 18 - - - - -	26-35

es
 58
 49
 47
 53
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